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ABSTRACT

The educational uses of familiar technologies such as telephones, computers, television sets, videocassette recorders, and radios as well as more sophisticated technologies like satellites, microwave television, and fiber optic systems are discussed. This guide explains how these telecommunication technologies operate, explores the possibilities they hold for the future of education in Wisconsin, and details how school districts can plan to incorporate them into their curricula. Topics include: (1) an overview of the education superhighway; (2) the origin and definitions of instructional telecommunications, with a focus on distance education; (3) current and potential instructional telecommunications uses in Wisconsin; (4) an analysis of the characteristics of each technology and examples of instructional uses in Wisconsin; (5) the need for a district plan and matching needs with technologies; (6) steps in the creation of the district plan; (7) plan implementation; (8) evaluation of the district plan and the implementation process; and (9) modification of the plan and implementation. Appendices include: instructional telecommunications and state and regional agencies; online services and networks; sources of cable TV and satellite programming; teaching through interactive television; instructional telecommunications technologies assessment instrument; plan and implementation process checklist; and a glossary of terms. (Contains approximately 70 references.) (MAS)

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INSTRUCTIONAL TELECOMMUNICATIONS

A Resource and Planning Guide

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Instructional Telecommunications:
A Resource and Planning Guide

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Contents

Page
Foreword ... v
Preface ... vii
Acknowledgments ... ix

1 Overview
Introduction ... 1
Education Superhighway ... 2
Gaining Access ... 4
References ... 4

2 Definitions and Origins
Definition of Instructional Telecommunications ... 5
Distance Learning ... 5
Why Instructional Telecommunications? ... 8
The Educational Restructuring Movement ... 8
Information and Technology Explosion ... 10
Wisconsin Educational Restructuring ... 11
Wisconsin Distance Learning Technology ... 12
References ... 14

3 Instructional Telecommunications in Wisconsin
Introduction ... 17
Overview ... 18
Technology Use in Wisconsin ... 19
Types of Educational Opportunities ... 20
References ... 25

4 Technologies Used
Introduction ... 27
Technology and Instruction ... 27
Types of Telecommunications Technologies ... 28
Telephone Wires ... 28
Radio ... 37
Broadcast Television ... 37
Microwave Television ... 39
Cable Television ... 44
Videotext and Teletext ... 47
Satellite ... 47
Fiber Optics ... 49
References ... 52

5 Matching Needs with Technologies
Introduction ... 53
Why Create a District Plan? ... 53
Purposes of a District Plan ... 54
Integrating Instructional Telecommunications ... 55
References ... 56

6 **The District Plan**

The Steering Committee 57
A Philosophy and Rationale 58
The Instructional and Technological Assessments 60
Creating an Instructional Telecommunications Plan 62
Articulating Curriculum 63
Calculating Costs 65
Identifying Financing Options 65
References 66

7 **Implementing the Plan**

A District Policy 68
Orientation and Staff Development Programs 68
Selecting District and Building Implementation Teams 70
Defining Roles and Assigning Responsibilities 70
References 71

8 **Evaluation of the District Plan and Implementation Process**

Evaluation of the Implementation Process 74
Evaluation of Staff Utilization 74
Evaluation of What Is Learned 75
References 75

9 **Modification of the District Plan and Implementation Process**

Reasons to Modify the Plan 78
Priorities for Change 78
References 79

10 **Appendixes**

A. Instructional Telecommunications and Other State and Regional Agencies 82
B. Online Services and Networks 86
C. Sources of Cable TV and Satellite Programming 94
D. Reaching and Teaching through Interactive Television 99
E. Instructional Telecommunications Technologies Assessment Instrument 103
F. Instructional Telecommunications Plan and Implementation Process Checklist 111
G. Glossary of Terms 126

Foreword

Many of the technologies discussed in *Instructional Telecommunications: A Resource and Planning Guide* are familiar to us all—telephones, computers, television sets, videocassette recorders, and even radios. We use these electronic devices so often that we take them for granted. However, their applications in schools are not as well known or understood. There are also newer, more sophisticated forms of technology being used today in education—satellites, microwave television, and fiber optics systems, to name just a few—that many educators know little about.

This guide will explain how these telecommunications technologies operate. It will also explore the possibilities they hold for the future of education in Wisconsin, and detail how school districts can plan to incorporate them into their curricula.

The technologies used in instructional telecommunications can open up new worlds of discovery for students, help them master the tools of the Information Age, and give all Wisconsin residents access to the widest possible range of educational experiences. They also offer new freedom for students. Instruction can now be delivered virtually anywhere, so learners are no longer bound geographically to the types of educational opportunities they receive. Instructional telecommunications can also give students independence by providing new teaching methods that place a greater emphasis on the student being an active participant in the overall process of education.

Exposure to these new technologies can help students gain a mastery of them that could help them succeed in work and other endeavors outside of school. We are now living in the Information Age. Knowing how to access the huge amounts of information available today, and how to use it to accomplish virtually any task, is a new form of power in modern society. The people who have this information power are the ones who will have the best chance to be successful in life.

The various forms of instructional telecommunications can even foster understanding among the nations of the world. Students in Wisconsin today are collaborating, via computer, with their counterparts in many other countries. These exchanges give students on either side of the computer screen insights into people with different cultures and backgrounds. Such direct communication could help to forge a new global understanding and a better future for us all. This kind of new learning opportunity also brings home with startling clarity how technology has made our world seem much smaller than ever before.

The technologies used in instructional telecommunications are new and powerful tools for teaching, so far-reaching, in fact, that they may create some changes in the process of education itself. These new technologies will not, however, change the fact that dedicated, enthusiastic educators are the most important factor in teaching our students. Technology is only a means to helping students and educators achieve their common goal, which is to acquire the skills and knowledge that can lead students to a better future.

John T. Benson
State Superintendent of Public Instruction

Preface

Education is being transformed, along with the rest of society, by the dawning of the Information Age. Today, as never before, society is experiencing explosive growth in the availability and variety of information resources, an ever-increasing need for information and lifelong learning skills, and the continued and accelerated development of new technologies. These factors have all combined to provide more opportunities for learning, as well as new and innovative methods of instruction. These changes have also expanded the mission of the school library media program, greatly broadening its scope and transforming the very way such facilities operate.

Satellite, cable and broadcast television, microwave, and fiber optics technologies, as well as increasingly sophisticated computer systems, are all capable today of transmitting massive amounts of information. Just as impressively this information—whether it is in the form of voice, data, or video—can be delivered directly to the classroom, library media center, work site, or even the home.

The people who master these new technologies are the ones who will have access to this growing information base, and who will be able to use it to enhance their lives in many ways. The purpose of *Instructional Telecommunications: A Resource and Planning Guide* is to explain how schools and districts can learn to use instructional telecommunications to foster quality education for their students.

School districts in Wisconsin have relied on modern technology to give students quality educational opportunities since the 1930s, when radio was first used as a medium for distance learning. Instructional telecommunications is, basically, the application of new technologies to accomplish the mission that distance learning fulfilled in the past. Telecommunications technologies can help teachers become more efficient and effective by allowing them to transmit instruction and resources to students no matter where they are. Instruction is no longer physically isolated in a solitary classroom, library, or media center.

These technologies can deliver instruction or information to other areas of the school itself; other school districts, towns, states, or countries; places of employment; and even to the homes of students and instructors. The type of instruction and resources delivered by these new technologies includes full-credit courses; specialized skills units and modules; computer online research and database inquiries; enrichment lessons; staff, administrator, and employee development and inservice programs; community education; and cultural enrichment programs.

Advancements in telecommunications have also created new opportunities for educational organizations to increase their effectiveness and scope of operation. Emerging technologies have enabled such groups to create new classroom and inservice instruction and to facilitate communication among all members of the educational community through electronic bulletin boards and other means. Technology will also help educational groups to conduct complex research on nearly any topic through the use of computerized bibliographic and text databases.

Instructional Telecommunications: A Resource and Planning Guide is an introduction to the concept of instructional telecommunications and to the ways in which these technologies are changing how schools educate students today. This guide explains new and emerging technologies as well as those that have been in use for many years. It also discusses the advantages and disadvantages of technology in education.

Most importantly, this book is a tool that will enable schools and districts to assess their instructional telecommunication needs. It shows districts, in a step-by-step manner, how to plan to meet the needs of their students both now and in the future.

Acknowledgments

The Department of Public Instruction's *Instructional Telecommunications: A Resource and Planning Guide* has been a priority of the Division for Libraries and Community Learning and the State Superintendent's Council on Instructional Telecommunications. An advisory committee of elementary and secondary school teachers, library media specialists, administrators, and representatives from the University of Wisconsin, the Wisconsin Technical College System, and educational interest groups was created to advise the department on the development of this guide. We wish to extend our sincere appreciation to the following members of this committee for their considerable contributions to the guide.

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Overview

1

Introduction

In his 1967 book *The Medium is the Massage*, Marshall McLuhan predicted that television and other mass media would transform the world into a "global village." When the Berlin Wall came down in 1989 and when allied forces made the first sorties of Operation Desert Storm in 1991, people around the world were able to watch live from the comfort of their homes. The dramatic scenes relayed by satellite gave life to McLuhan's contention that: "The new electronic interdependence recreates the world in the image of a global village." (McLuhan and Fiore, 1967) The fulfillment of his prediction concerning the effects television and other mass media would have on the way people view their world, and even themselves, can be seen in many ways today.

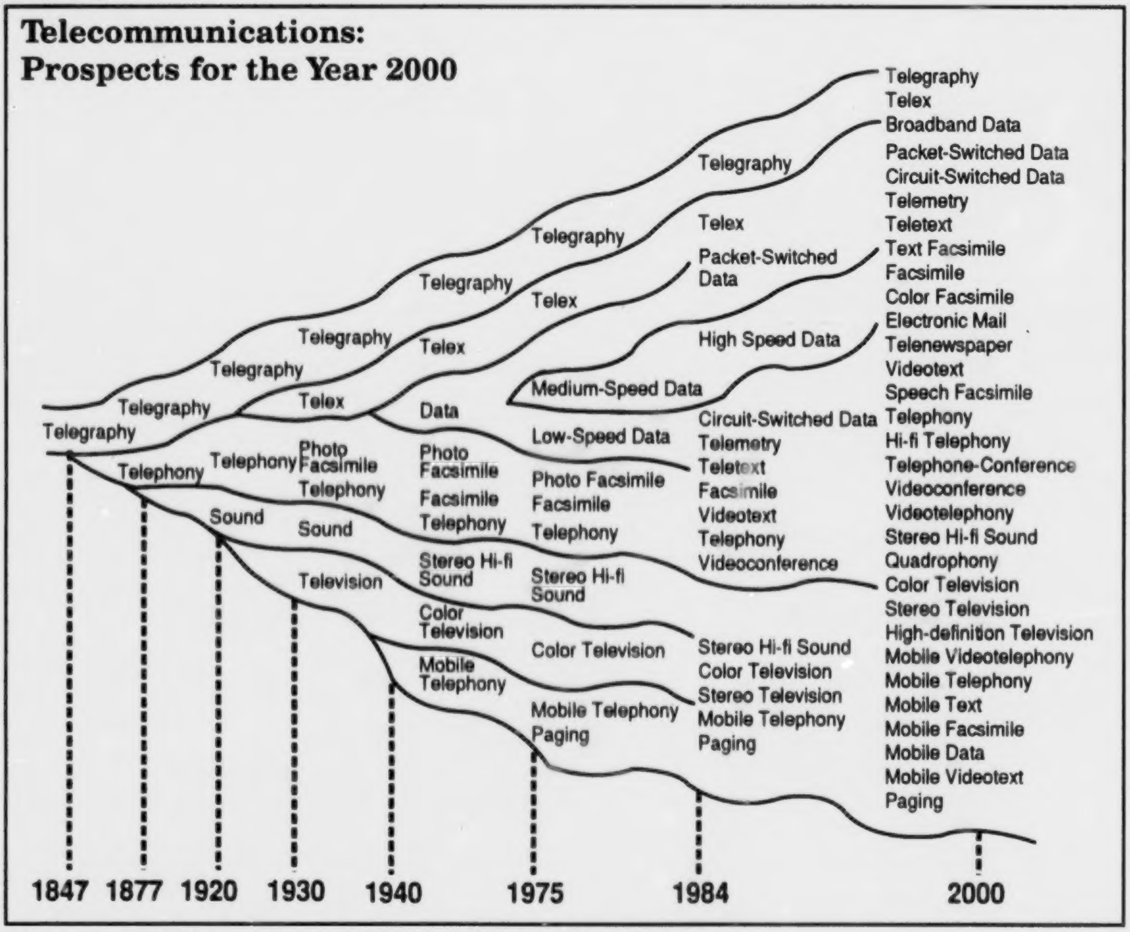
In that same book, McLuhan nearly 30 years ago also wrote: "The medium, or process, of our time—electric technology—is reshaping and restructuring patterns of social interdependence and every aspect of our personal life . . . . Everything is changing—you, your family, your neighborhood, your education, your job, your government, your relation to 'the others.' And they're changing dramatically. Societies have always been shaped more by the nature of the media by which men communicate than by the content of that communication."

Although advancements in technology may have outstripped even McLuhan's imaginative scenario for the future, his comments are just as apt now as they were in 1967. Today, an information superhighway of global dimensions is being developed—one that is capable of linking people around the world more intimately than television images ever could. This superhighway connecting the world electronically is not only an express lane to the future, but a means of changing the present and shaping the future itself.

The path of this electronic highway is paved not with asphalt or concrete, as are highways that connect people physically, but with new forms of telecommunications capable of transporting information between people around the world. These technologies include telephone lines, satellite systems, fiber optics, radio and television transmissions, computers with modems, fax machines, and cellular phones. They transport voice messages and conversations, data, graphics, still or full-motion video, sound, and electronic mail (e-mail) messages.

Figure 1 is a historical timeline for development of communications technologies, beginning with the advent of telegraphy in 1847. The ever-quickening pace of technological refinement can easily be seen, especially in the many new advances that occurred in just the brief time span of 1975 through 1984. Some forms of telecommunications listed for the year 2000 are still being developed, but most have already become an accepted part of everyday life in the new, high tech world of the late 20th century.

Figure 1


Telecommunications:
Prospects for the Year 2000
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Medium-Speed Data
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Low-Speed Data
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Telephony
Sound
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Stereo Hi-fi Sound
Stereo Hi-fi Sound
Television
Color Television
Color Television
Mobile Telephony
Mobile Telephony
Paging
Circuit-Switched Data
Telemetry
Teletext
Facsimile
Videotext
Telephony
Videoconference
Stereo Hi-fi Sound
Color Television
Stereo Television
Mobile Telephony
Paging
Telegraphy
Telex
Broadband Data
Packet-Switched Data
Circuit-Switched Data
Telemetry
Teletext
Text Facsimile
Facsimile
Color Facsimile
Electronic Mail
Telenewspaper
Videotext
Speech Facsimile
Telephony
Hi-fi Telephony
Telephone-Conference
Videoconference
Videotelephony
Stereo Hi-fi Sound
Quadrophony
Color Television
Stereo Television
High-definition Television
Mobile Videotelephony
Mobile Telephony
Mobile Text
Mobile Facsimile
Mobile Data
Mobile Videotext
Paging
1847
1877
1920
1930
1940
1975
1984
2000

Source: Warr, Wendy A., and Martyn P. Wilkins. *Online* 14.2 (Mar. 1990), p. 53.

The telecommunications infrastructure, once in place, can be used for an unlimited number of tasks in business, industry, entertainment, and, most assuredly, in education. The various technologies that deliver instructional telecommunications extend education beyond the physical boundaries of a single classroom, school building, or school district. They can also open up a world of new educational opportunities for students and instructors alike.

Education Superhighway

An important segment of the information superhighway is the education superhighway. This new path for education can directly link students and instructors to other schools in the same district, or even to schools in other states or countries. The development of instructional telecommunications has meant that instruction or instructional resources can now be delivered almost anywhere. It no longer matters if a student or teacher is in a small, rural district or a large, metropolitan system. Everyone today can have access to needed information or instruction by taking advantage of new technologies.

Here are examples of how the technologies of instructional telecommunications are being used today in Wisconsin to bring new learning opportunities to students. These technologies are so powerful, they are even changing the way students are being educated.

- Sixth-grade students at North Middle School in Menomonee Falls use Internet, the global computer network, to travel the information superhighway all the way to Indonesia, Australia, Iceland, Denmark, or Kuwait. Students use computers with modems (a device that transfers computer communications over the telephone) to exchange letters with pen pals in those far-off countries. One class in 1994 even collaborated with about 60 other schools around the world to write a story involving dinosaurs and scientists. It was titled "Project Dinobones." (Schumacher, 1994)

- For nearly 20 years Project CIRCUIT (Curriculum Improvement Resulting from the Creative Utilization of Instructional Two-way Television) has helped eight Trempealeau County school districts expand their curriculum and resources. Project CIRCUIT uses coaxial cable and microwave technology to provide quality educational opportunities that the school districts, individually, might not have been able to offer students. Courses have included foreign languages, blueprint reading, and work with advanced computers. The districts involved are Arcadia, Alma Center-Humbird-Merrillan, Blair-Taylor, Eleva-Strum, Galesville-Ettrick-Trempealeau, Independence, Osseo-Fairchild, and Whitehall.
- West Salem Middle School students in 1994 were enrolled in The World School for Adventure Learning. Students accessed Internet to communicate with polar explorer and educator Will Steger. Steger, who with a team of international explorers was preparing for a 1995 expedition to the North Pole, used the computer system to help educate students around the world about the Arctic. Students had access to information Steger provided daily. They could also ask questions and establish a dialogue on the subject with this explorer.
- High school students in small, rural communities in northern Wisconsin learn calculus from a professor in Stillwater, Oklahoma, and Japanese from a school teacher in Lincoln, Nebraska, through a course delivered by satellite. In addition, high school students in large urban schools in the eastern part of Wisconsin can learn Japanese from a teacher in the next school district via television. Or they can compose and publish essays, poetry, and short stories in collaboration with students from other urban schools on the east and west coasts. This collaboration is made possible by computers that enable students to communicate over those long distances.
- Students in the Belleville district use videotapes, speaker phones, electronic mail, and computer software to exchange information, school projects, and letters with their counterparts in a small school in Finland. Students in German and computer science at Waupaca High School use e-mail to work on collaborative projects with a sister school in Germany.

A complete listing of such activities would be a very long one because most school districts in the state have already adopted some form of instructional telecommunications. Wisconsin is only part of a greater movement nationally and globally toward the expanded use of instructional telecommunications. Here are some examples of what other states are doing.

- Montana's Big Sky Telegraph System, founded in 1988, originally linked the state's 114 one-room schools with each other and with Western Montana College in Dillon. Now this system has expanded to provide business, professional, and cultural groups throughout the Rocky Mountain states access to people and information locally and globally. (Brenden, 1991)
- The National Native American Teleteaching Network consists of more than 1,300 college students and 200 teachers at five tribal-run community colleges in five midwestern and western states. This telephone and computer-based audiographics network provides instructional programming to small, rural, and relatively isolated colleges and K-12 school districts in the five states. (Lorenc, 1990)
- Administrators, faculty, and elementary, secondary, and college students in Indiana use computers to access the Electronic School District (ESD). ESD is a menu-driven system covering administrative, general classroom, math, science, humanities, and student services information. Individuals can research topics such as Indiana University admission policies, health, Indiana geology, and weather. They can also call up lesson plans, take part in discussions, or send and receive electronic mail. (Council of Wisconsin Librarians, 1991)
- Students in five Michigan inner-city schools receive satellite-based programs designed to stimulate interest in science and math. Telecommunications technology enables students and teachers to interact with master teachers and minority role models assembled in the studio where the programs originate. This satellite instruction is reinforced by hundreds of mentors recruited from local corporations, or-

ganized labor, and professional societies, who relate classroom activities to everyday career experiences. (*Education Computer News*, 1990, p. 3)

As can be seen from these examples, the technologies of instructional telecommunications today are giving teachers and students access to a new world of previously unavailable learning opportunities. In general terms, they include access to

- quality educational experiences regardless of the size of the school or its geographic location;
- quality educational experiences not otherwise available to students of racial, cultural, or linguistic minorities because of social, political, economic, or geographic variables;
- subject matter, content experts, public officials, and career models not available in the local community;
- instructional resources from virtually anywhere in the world;
- techniques and facilities to rapidly share ideas, information, and data;
- advanced placement (AP) or "tech prep" courses offered by university or vocational and technical campuses throughout the state;
- teachers and students in other schools who can provide an understanding of other cultures;
- businesses, industries, and community organizations that can create learning partnerships with local teachers and students;
- staff development programs and continuing education courses that can meet the particular needs of participants; and
- electronic bulletin board systems (bbs) and electronic mail (e-mail) systems that facilitate collaborative and cooperative learning among students, teachers, scientists, and others.

Because of the tremendous impact of these technological advances on society today, educational needs have changed and will continue to change drastically. The skills and competencies deemed essential for success in life are also evolving, as are the way many things are done.

Schools in the future will continue to play a major role in educating students and communities. Indeed, the telecommunications technologies being developed will enable them to create more productive learning environments and teach more students than ever before.

Gaining Access

Access to these new educational experiences is no longer dependent on the physical proximity of the school district to those resources. Access is dependent upon increasingly affordable technologies that are available in most, if not all, school districts in Wisconsin.

The basic premise of this guide is that technology is a path to the future for schools and students. It stresses that the most cost-effective and instructionally efficient way to adopt instructional telecommunications is to first establish clear instructional goals, and to then match technology to those goals.

This guide will help teachers, administrators, curriculum directors, and educational planners in local school districts and cooperative educational service agencies (CESAs) by

- providing definitions and origins of instructional telecommunications and distance learning;
- illustrating how technologies are used in classrooms in Wisconsin and other areas;
- examining and explaining these technologies; and
- presenting a strategic planning model for assessing instructional needs and matching those needs with instructional telecommunications technologies in the classroom.

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Definitions and Origins

2

Definition of Instructional Telecommunications

The Greek word *tele*, which means "far off," is one of the root words of telecommunications. Thus telecommunications technologies are those that communicate "at a distance," and instructional telecommunications is the use of electronic technologies to conduct distance learning. The various telecommunications technologies can transmit voice, video, and data, or any combination of those forms of information, to communicate with and teach skills to students in geographically separated locations.

Instructional telecommunications technologies make possible the delivery of telecourses, live interactive television, research of far-off databases, exchanges of information, and audio, video, and computer conferencing. All these examples of instructional telecommunications use electronic technology, provide for interaction, and link students with their instructors, an information base, or both. Print correspondence courses are not classified as instructional telecommunications unless they incorporate an electronic technology component.

Figure 2 illustrates how several common telecommunications technologies are used to relay instruction. Satellites send television signals to dishes located on the ground. Those signals can then be broadcast to a class, rebroadcast on another technology such as Instructional Television Fixed Service (ITFS), or videotaped for delivery to schools at a later date. These technologies are often used together to deliver instruction.

Technology-assisted instruction can take many forms. They include the following:

- complete credit courses,
- specialized units and modules,
- online computer research and database inquiries,
- enrichment lessons that can be added to the existing curriculum,
- staff, administrator, or employee development and inservice programs, and
- community education and cultural enrichment programs.

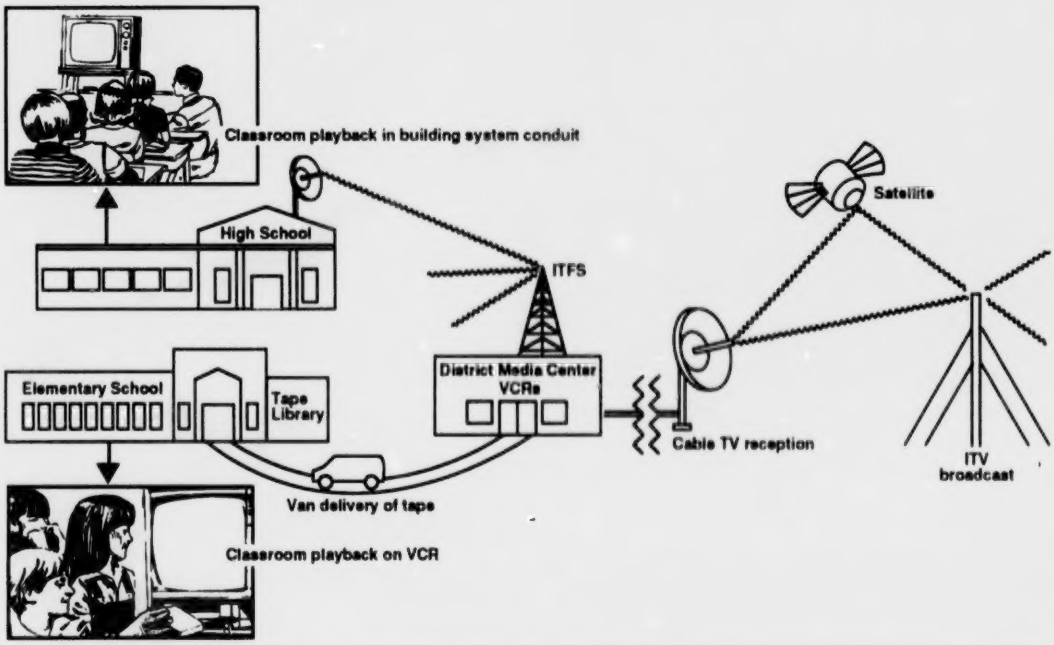
Distance Learning

Distance learning is a category of education carried out through the use of instructional telecommunications. Distance learning can be defined many ways, but each definition contains the components of distance, technology (or some medium), content, teachers, and students. Distance learning is sometimes referred to as distance education or distance teaching. The three terms are basically interchangeable, although each one can underscore philosophical differences on the subject. In this guide the author will generally use the term distance learning except in direct quotes from source material when *distance education* or *distance teaching* is mentioned.

As the U.S. Office of Technology Assessment points out in *Linking for Learning: A New Course for Education* (1989), distance learning in elementary and secondary schools has increased dramatically in the last few years. In the mid-1980s few states were active in this

Figure 2

A Multitechnology Distance Learning System



field, and as recently as 1987 only ten states promoted distance learning. One year later, two thirds of the states reported involvement, and by 1989 virtually every state was engaged or interested in distance learning.

Early definitions of distance learning came from traditional education models. These models assumed that the teacher's role was to instruct and the student's role was to learn. The traditional teaching model involved a curriculum that defined the scope of the class subject matter and ordered the sequence in which content was delivered to the student during the course of study. Students had to accomplish a series of specified goals and objectives in order to master a clearly defined and carefully organized set of competencies. (Wilson, 1986, p. 10)

Content was embedded in the instructor's lectures, textbooks, and other printed material such as assigned reading, exercise sheets, and workbooks. To expand the basic course content, the student needed access to additional books and materials that could be obtained locally or through interlibrary loan. After World War II the advent of audiovisual materials increased the types of content available to both instructors and students. However, print-based material was still the dominant medium, and the traditional teacher-student relationship was still the primary component in the learning model.

Instructional telecommunications includes all of these components, while being able to add new parts to the education model that were previously impossible. By no means do telecommunications technologies replace the basic instructor-student relationship in the traditional education model. But they do release the relationship from one that is place-bound by providing the student access to instruction and resources from other locations in electronic print, audio, and video formats. These technologies link students and teachers directly with outside sources of teaching and information. This fosters a new relationship between student and teacher in which the teacher may not play a direct role in the transfer of information to the student. Instead, the teacher can become a coach, a mentor, or a guide.

Early Distance Learning Models

Distance learning has its roots in the print-based correspondence education movement. Anna Eloit Ticknor, a New England educator, used U.S. mail service to reach homebound women who could not participate in traditional schooling. Ticknor founded the Society to Encourage Studies at Home in 1873. William Harper, the first president of the University of Chicago, in the late 1870s began the first university-level correspondence teaching department. He is often referred to as the "father of correspondence teaching." (Barron, 1989, p. 28)

The United States, the former Soviet Union, Germany, India, Canada, France, Australia, and New Zealand all offered print-based university extension services for part-time, off-campus students long before adapting electronic technology to deliver distance learning. (Bates, 1984, p. 3) The event that marked the transformation from correspondence education to distance learning, however, was the establishment of the Open University in Great Britain in 1969. (Garrison, 1989, p. 1)

The Open University is based on a combination of broadcast technology (television and radio) and specially written textbooks supported by a system of part-time tutors and counselors. In just 13 years the university grew from 25,000 students to more than 100,000, expanded course offerings from four to more than 150, and increased its television transmission time from about four hours to more than 35 hours a week. (Bates, 1984)

Early definitions of distance learning reflected its print-based origins, in which the primary component of distance learning was the interaction between teachers and students over some medium. But these early definitions also emphasized the quality of learner independence—an independence from place and time constraints as well as a greater freedom for students to choose what they wanted to learn.

Michael Moore, director of the American Center for the Study of Distance Education at Pennsylvania State University, wrote his doctoral dissertation on distance learning at the University of Wisconsin (UW) Madison. He emphasizes the teacher's role when he defines distance learning as ". . . the family of instructional methods in which the teaching behaviors are executed apart from the learning behaviors, including those (behaviors) that in a continuous situation would be preferred in the learner's presence, so that communication between the teacher and the learner must be facilitated by print, electronic, mechanical, or other devices." (Moore, 1973, p. 64)

Charles A. Wedemeyer, a retired professor of the UW-Madison School of Education, emphasizes the student's role when he defines distance learning in terms of "independent study" that ". . . consists of various forms of teaching-learning arrangements in which teachers and learners carry out their essential tasks and responsibilities apart from one another, communicating in a variety of ways, for the purposes of freeing internal learners from inappropriate class pacing or patterns or providing external learners opportunity to continue learning in their own environments, and developing in all learners the capacity to carry on self-directed learning . . . ." (Wedemeyer, 1977)

In later works Moore and Wedemeyer both emphasize the role of learner "independence" in the distance learning model. Distance learning by its very nature embodies a "learner-centered educational universe." In this "universe," the role of the teacher and the learning institution is to provide students with a rich variety of materials. These resources give learners the opportunity to learn and experience what is important for them at a particular time, as well as the chance to exercise choice and responsibility in making educational decisions. (Moore, 1988) And much ". . . as a child-centered teacher provides a rich environment of learning materials, and responds to the self-directed learning of the individual pupil in the classroom, the education institution now has the technical power to respond to each individual learner as, in his [or her] interaction with his [or her] environment, he [or she] identifies learning needs and makes them known, and enters into programs of independent studies." (Moore, 1988)

Borje Holmberg, who once taught at UW-Madison, is a professor of Open Learning at Fern University in Hagen, Germany, and specializes in the methodology of distance learning. He prefers to emphasize the role of the delivering organization when he defines distance learning as ". . . the various forms of study at all levels which are not under the continuous, immediate supervision of tutors present with their students in lecture rooms or on the same premises, but which, nevertheless, benefit from the planning, guidance, and tuition of a tutorial organization." (Holmberg, 1977, p. 9)

More recent definitions still emphasize the relationship between the teacher and student as the primary instructional mode. D.R. Garrison, associate professor and Director of Distance Education at the University of Calgary states that to be comprehensive, distance learning must include all legitimate educational activities between a teacher and a student who are physically separated. In emphasizing the role of communication between the teacher and student, Garrison identifies three criteria for defining distance learning:

- "distance [education] implies that the majority of educational communications between (among) teacher and student(s) occurs non-contiguously;
- distance [education] must include two-way communication between (among) teacher and student(s) for the purpose of facilitating and supporting the educational process; (and)
- distance [education] uses technology to mediate the necessary two-way communication." (Garrison, 1989, p. 11)

However, Virginia A. Ostendorf, an international consultant on distance learning, emphasizes the role technology plays by defining it as "... the delivery of live, real-time instruction to a person or persons who are physically remote or located at a distance ...." (Ostendorf, 1989, p. 1)

This definition comes closest to the one preferred and used in this guide. It emphasizes "the delivery" of instruction rather than the relationship among the instructor, the student, and the content. This definition does not bind the learning process to instructor and student interaction. This definition implies, instead, that the primary component in distance learning is the relationship of the learner to the instructional material. This material may reside in a database or online repository or may be instruction delivered by a teacher—all of which is physically distanced from the learner. The material may be located in another public school, a major university, or informal learning institutions such as museums and public libraries. This delivery of instruction provides expanded services to the learner, while also creating new relationships between institutions and their users.

In this definition the use of technology to deliver instruction, in effect, creates a classroom without walls or artificial boundaries except those imposed by the learner. This does not mean that there is no place for the instructor and the curriculum in the learning process. Indeed, these are still important components, especially for elementary and secondary students. And the systems that link learners with instructional materials also link learners with instructors throughout the world. Ostendorf is saying that what is of primary importance is the use of technology to link subject matter or content with the instructional needs of the learners.

Although each distance learning model reviewed above emphasizes a different set of factors, each one ultimately describes a process of instruction that is qualitatively different from the traditional classroom instructional model. Because distance learning can be learner-centered and delivered by technology, it can actively engage students to construct their own knowledge and understanding. It can also create a learning environment in which teachers can be less directive toward, and more supportive of, students and their learning processes.

Why Instructional Telecommunications?

Two key factors have combined in recent years to make instructional telecommunications a major, rapidly growing component of education. The first is the current educational restructuring movement, which contends that schools are out of step with the times and that nothing less than a major restructuring will make a difference. The second factor is the explosion in the amount of information available to teachers and students. Information is expanding at an unprecedented rate. In order to keep pace with this growth, there have also been revolutionary changes in technologies that organize, store, and access this information.

The Educational Restructuring Movement

Calls for restructuring education are not new. For the last century, reform movements have swept through this most basic social institution in repeated attempts to realign education to reflect the dynamic, ongoing changes taking place in U.S. society.

The current educational restructuring movement began with the release of *A Nation at Risk: The Imperative For Educational Reform* (1983). Written by the National Commission on Excellence in Education, this report warned that "a rising tide of mediocrity" in school systems threatened to erode the foundations of the United States. The U.S. secretary of education commissioned the report at a time when government and industry were looking critically at the nation's ability to compete in a rapidly changing global environment.

The commission stated that the basic ingredients for reforming education are excellence, equity, and creation of a learning society. Excellence and equity are both essential if students are to be given the chance to learn and live according to their aspirations and abilities. They are also essential to the well-being of a nation that exists in a greater world of accelerating competition and change. Excellence in education can give people the competitive margin of knowledge and skills needed today. And equity of access to educational excellence ensures that all citizens will be able to compete in this dynamic society to the best of their abilities.

The report also said that to deal with the current pace of change and competition, education must be restructured to create a learning society. It must be one that affords all members the opportunity to develop their minds to full capacity and to continue to learn from early childhood through adulthood. Educational opportunities should extend beyond traditional institutions of learning to homes, work sites, libraries, art galleries, museums, science centers, or any other places in which an individual can develop and mature. In the commission's view, formal schooling for youth is the essential foundation for learning throughout life. And providing lifelong learning opportunities to young people and adults alike will ensure that their skills will not become obsolete.

Within six months of the release of the report, 165 task forces on educational reform had been established in 50 states and the District of Columbia. These task forces consisted of parents, educators, legislators, employers, and other interested citizens. Eventually, more than 100 reports echoed the commission's concerns about the condition of education in the United States, calling attention to the need to restructure schools because of the dramatic changes occurring in American society in general.

In an attempt to realign the characteristics of school restructuring to reflect current and future societal changes that are affecting present educational structures and practices, Steven Benjamin (1989) reviewed 209 documents published by "educational futurists." Benjamin, Coordinator of Curriculum and Instruction for the Metropolitan School District of Decatur Township in Indianapolis, Indiana, compiled the following "trends" school restructuring should address.

- Because knowledge in the future will have a "short half-life," students must engage in the process of learning rather than sit at a desk listening to a teacher lecture.
- Because the nature of society in the future will be technological, overloaded with information, interdependent, global, and change-driven, students and citizens must be able to think critically, uncover bias and propaganda, reason, inquire, use the scientific process, remain intellectually flexible, think about complex systems, think holistically, think abstractly, be creative, and view and read critically.
- Because of the increasing rate and complexity of change in the modern world, in which knowledge, skills, and values become obsolete more rapidly, education can no longer be reserved for only the early years of life.
- Because citizens will live in an environment in which people will continue to forge complex social and technological systems, things like general processes, general knowledge, and basic skills will be more important than specialized knowledge and skills.
- Because of the interdependent nature of the world, complexities of today's problems require solutions drawn from knowledge in various fields in order to foresee other problems that may be created by shortsighted solutions. Therefore, learning must be centered around ideas and problems, not fragmented into discrete subject areas controlled by a seven-period day. Curriculum must be based on activities and ideas and organized into transdisciplinary themes.
- Because of cultural, ethnic, and global diversity, personalized learning must be instituted to preserve differences among people as a source of creativity and diversity.
- Because of the need for personalized learning, a collaborative role between teachers and students must allow students to accept an active, partnership role in learning.

Instructional telecommunications can be an integral part of this restructuring because it addresses the basic ingredients of these trends. Instructional technologies provide students and teachers access to resources and educational opportunities in any instructional mode. They are available to all citizens, regardless of whether they live in an urban community rich in instructional resources, or a small, rural community isolated from resource-rich environments. Instructional telecommunications technologies extend the classroom experience beyond the walls of traditional learning institutions. They can electronically transport a student or teacher across the county, state, and nation, or even entirely around the world. These technologies also bring data, information, and communication capabilities to the student or teacher whether they are in school, at home, at a local public or school library, or at work. The only requirement is a basic set of increasingly affordable technologies.

In addition, technology is helping teachers restructure the classroom's traditional learning environment. For instance, production capabilities of computers and video cameras enable students to be creative in ways not previously imagined. Computer software makes it possible for students to simulate complex scientific, economic, or historical events and to explore their underlying variables and relationships. Also, the public nature of computer work in the classroom can foster collaboration, discussion, and reflection among students. Here the teacher's role is to collaborate and facilitate individualized and small group instruction.

Information and Technology Explosion

The second trend spurring the increased use of instructional telecommunications in the classroom is the explosive growth in the amount and availability of information. The nation's employment base is changing from one that was predominantly manufacturing to one that is more service-oriented, with an increasing number of information workers. The information base is expanding at an unprecedented rate, doubling every two to three years, and significant improvements are being made in technology for handling this data. People need access to this information base so they can satisfy their personal and business needs.

The rapid growth of information is due to the use of computers to conduct scientific research on social and scientific topics and to analyze, store, and retrieve data or information. Also, telecommunications technologies that help researchers to instantly share scientific data with other scientists has speeded the creation of new information by making more knowledge available to more people. (Hefzallah, 1990)

There also have been dramatic increases in the speed with which this information can be transmitted. Joseph Pelton, a researcher who studies the effects of telecommunications on society, estimates that a person thinks, speaks, or writes an average of 27,000 words a day. If a person lives to be 70 years old, Pelton calculates the typical information use in the course of an individual's lifetime is about 20 billion bits of information. (The term "bit" is short for binary digit, the smallest unit of information a computer can process.) Currently satellites, fiber optics systems, and super-computers are capable of transmitting 20 billion bits of information in seven to 20 seconds. And these technologies are expected to be able to cut that transmission rate to a second or less by the year 2000.

The dramatic increases in the speed of communications can be understood by considering Integrated Services Digital Network (ISDN), the worldwide standard for transmitting speech or other sound. ISDN uses regular telephone lines to integrate voice, video, and data transmissions into a single digital signal that can be sent over one line or telecommunications system. In the near future, ISDN will enable the transfer of digitized data at the rate of one five-million-word book in a single second. And that high-speed communication will have an error rate of only one bit of information in ten million. At that rate of transmission a person would have to be able to read a 15,000-page book in a single second, while making only 15 errors of recognition out of 150 million possibilities. (Pelton, 1990)

In today's society, access to information is a powerful tool. New technologies, including those of instructional telecommunications, have placed large amounts of information power in the hands of those who know how to operate them. Consequently, information literacy is a survival skill, and to function fully, people cannot be paralyzed by the abundance of information resources available. People must become information literate. They must learn how to find, evaluate, and process information effectively to solve problems and make decisions—whether this data resides in a computer, book, videotape, audiotape, or other storage medium.

The growth of information and evolution of technologies is having a profound effect on schools today and will continue to do so in the future. The technologies that empower the learner by providing access to unlimited instruction and content also empower teachers. They give teachers access to new instructional content, new experts on content and methodology, and students they would not otherwise have been able to reach. These students may be of diverse cultural, racial, linguistic, and geographic backgrounds—differences that may enhance many classroom discussions or exercises. Technology could actually help teachers to reach more students in a few years than they could in a lifetime of direct classroom instruction.

A school in the Information Age will be more interactive. Students will become learning partners with other students, teachers, information resources, and the community. Teachers will function as coaches and guides as well as lecturers. Teachers and students will use a classroom computer to access libraries and databases around the world for facts and information. Teachers will work regularly with library media specialists and designers of instructional programs, both within their schools and in their communities. This will help ensure that student projects and explorations are challenging, interesting, and productive learning experiences. Student progress will be evaluated on a broad range of indicators, including assessments of the quality and appropriateness of information sources they use and the quality and efficiency of their information searches. (American Library Association, 1989)

Wisconsin Educational Restructuring

Educational restructuring is one factor that has helped bring instructional telecommunications to prominence in recent years—and Wisconsin has been active in this movement since its inception. In response to the report by the National Commission on Excellence in Education, the state legislature increased the number of Wisconsin Educational Standards from 13 to 20. The intent of the standards is to provide equal access to educational opportunities for students throughout the state, as well as a variety of opportunities for educators to upgrade their skills to better meet student needs.

Wisconsin's standards are based on current educational literature and on research about effective schools. They identify seven essential elements that schools must have to meet the learning needs of all students. (Gomoll, 1988) They are

- a clear school mission and instructional program to carry it out,
- strong instructional leadership,
- an orderly school learning climate,
- ample opportunity for students to learn,
- high pupil expectations,
- frequent monitoring of pupil progress, and
- a high degree of parent and community involvement in the schools.

Each of the 20 standards has a direct relationship to one or more of the seven elements of school effectiveness. Instructional telecommunications technologies can directly address several standards, including the following:

Standard (b). Each school board shall annually establish a professional staff development plan designed to meet the needs of individuals or curriculum areas in each school.

Standard (l). Each school board shall provide regular instruction in the basic skill areas as well as health, physical education, art, and music in grades K-8; career exploration and planning in grades 5-8; and "access" to an educational program that includes English, social studies, mathematics, science, vocational education, foreign language, physical education, art, and music in grades 9 through 12. "Access" is defined as an opportunity to study through school district course offerings, independent study, cooperative educational service agencies, or cooperative arrangements between school boards and postsecondary institutions.

Standard (m). Each school board shall provide access to an approved education for employment program.

Standard (n). Each school board shall develop a plan for children at risk.

Standard (p). Each school board may grant a high school diploma to pupils who have completed a program which includes 13 credits of a basic core curriculum, plus a minimum of 8.5 additional credits in vocational education, foreign languages, fine arts, and other courses.

Standard (t). Each school board shall provide access to an appropriate program for pupils identified as gifted and talented. (Wisconsin Department of Public Instruction, 1987)

Establishment of these standards marked only the beginning of Department of Public Instruction (DPI) involvement in the effort to restructure and improve public education. The DPI, in cooperation with educators and community members from around the state, has continued to work to enhance the quality of public education in Wisconsin. (Wisconsin Department of Public Instruction, 1988) A major step came in 1993 when the DPI issued its report on *Wisconsin Learner Goals, Outcomes & Assessment*. This report was prepared with the help of hundreds of educators and other community members from throughout Wisconsin.

The report establishes ten learner goals that outline expectations for students. Instructional telecommunications can be seen as a prime tool to accomplish several of these goals including 1) building a substantial knowledge base, 2) developing thinking and communication processes, 4) acquiring the capacity and motivation for lifelong learning, 8) being prepared for productive work, and 9) respecting cultural diversity and pluralism.

The DPI also endorsed 17 learner outcomes. Instructional telecommunications can be seen as a possible tool for helping to accomplish many, if not all of them. The outcomes that would seem to benefit most from instructional telecommunications are these:

Outcome 2. Revise a product, performance, system, and idea in response to relevant information.

Outcome 3. Make informed decisions by examining options and anticipating consequences of actions.

Outcome 8. Transfer learning from one context to another.

Outcome 12. Defend a position by combining information from multiple sources.

Outcome 14. Recognize when a need for specific information exists and demonstrate the ability to locate, evaluate, and use the relevant information.

Outcome 15. Conceive of places, times, and conditions different from one's own.

Outcome 17. Recognize the influence of diverse cultural perspectives on human thought and behavior.

The learner outcomes listed above are those most closely connected to skills such as gathering information and being able to understand and compare various sources of data. They also stress a sense of being connected to the outside world. The technologies in instructional telecommunications can help to achieve these learner outcomes and accomplish many other important tasks in education.

The DPI today is continuing its work with students, teachers, administrators, school boards, legislators, and citizens to ensure quality education in Wisconsin. Working together, state educators have been able to initiate improvements in areas such as curriculum development, testing, graduation standards, education for employment, helping children at risk, early childhood education, gifted and talented education, and special education.

Initiatives in these areas address hallmarks of excellence and equity. They ensure that components considered essential to creating an atmosphere in which excellence can prevail are available to all students throughout the state, regardless of location.

Wisconsin Distance Learning Technology

The second factor that has helped bring instructional telecommunications to the forefront of education is the explosion in information and the accompanying technological improvements in dealing with this expanded knowledge base. *The Wisconsin Distance Education Technology Study* (1993) pulled together information about the various projects, technologies, and distance learning programs that were in place throughout the state. This study also considered how the evolution of technology and distance learning could affect Wisconsin schools in the future.

This study was done under the direction of the Wisconsin Educational Communications Board (WECB), with participation by the DPI, the state board of the Wisconsin Technical College System (formerly known as the state's Vocational, Technical and Adult Education System), and the University of Wisconsin System. The study included

- a comprehensive statewide distance learning needs analysis;
- development of technical alternatives for meeting the identified needs;
- analysis of, and recommendations for, the WECB's statewide television and FM radio systems;
- recommendations for ongoing development of a statewide distance learning system; and
- development of modeling tools and information databases that can be used in future statewide planning.

This study identified distance learning needs common to most educational institutions in the state. They are as follows:

- Institutions need to be able to provide an outreach function to equalize educational opportunities in currently underserved areas, share instructional resources, reduce travel time and costs, and reach students who might not otherwise have access to equivalent educational opportunities.
- Institutions need access to professional development courses, including continuing education and training for adults, instructors, and agency professionals.
- Institutions need access to library databases and other data networks.
- Institutions need to educate their staff about the capabilities, benefits, and technologies associated with the concept of distance learning, and need to establish local and state-level planning groups to share expertise and aid coordination among regions of the state.

This study also found the need for

- a statewide distance learning plan compatible with regional distance learning systems already in operation in the state;
- state government assistance to local districts, schools, and agencies concerning funding, grant applications, distance learning planning resources, and technical expertise;
- state government assistance with vendors, Request for Proposal (RFP) creation, evaluation of RFP responses, and contract negotiations; and
- establishment of partnerships between educational institutions and private business and industry so companies will have access to educational coursework and training materials.

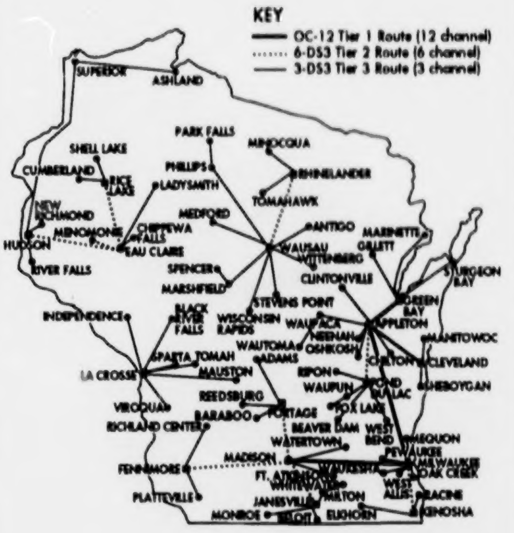
Based on these findings, the study recommends that a statewide distance learning network consist of three basic tiers: the overlay network, regional networks, and local networks. Each of these systems requires a different level of state involvement, as well as an interface with a distinct category of service providers.

For instance, primary responsibility for the overlay network would most properly rest with the state, which would contract with appropriate major service providers to perform this function. Local networks would generally be the primary responsibility of individual school districts or institutions working in conjunction with local telephone or cable television companies. Regional networks would be the responsibility of individual institutions or consortiums.

The state overlay network (see figure 3) would serve to interconnect multiple regional networks with voice, video, and data signals. Both fiber optics and microwave systems can be used for this part of the network. The 1993 study indicates that it would probably take up to ten years to fully implement this network, with the primary routes being among the first parts of the system to be installed.

Figure 3

Wisconsin Overlay Distance Education Network (WODIE)


KEY
OC-12 Tier 1 Route (12 channel)
6-DS3 Tier 2 Route (6 channel)
3-DS3 Tier 3 Route (3 channel)
SUPERIOR
ASHLAND
PARK FALLS
MINOCQUA
SHELL LAKE
CUMBERLAND
RICE LAKE
PHILLIPS
LADYSMITH
RHINELANDER
TOMAHAWK
NEW RICHMOND
MEDFORD
HUDSON
MENOMONIE
CHIPPEWA FALLS
EAU CLAIRE
ANTIGO
WAUSAU
WITTENBERG
MARINETTE
GILLETT
RIVER FALLS
SPENCER
MARSHFIELD
CLINTONVILLE
STURGEON BAY
STEVENS POINT
GREEN BAY
INDEPENDENCE
BLACK RIVER FALLS
WISCONSIN RAPIDS
WAUPACA
APPLETON
NEENAH
OSHKOSH
MANITOWOC
WAUTOMA
ADAMS
SPARTA
TOMAH
CHILTON
CLEVELAND
LA CROSSE
MAUSTON
RIPON
WAUPUN
FOND DU LAC
SHEBOYGAN
REEDSBURG
VIROQUA
BARABOO
PORTAGE
FOX LAKE
RICHLAND CENTER
BEAVER DAM
WEST BEND
WATERTOWN
MEQUON
MADISON
PEWAUKEE
MILWAUKEE
FENNIMORE
WAUKESHA
OAK CREEK
FT. ATKINSON
WHITEWATER
WEST ALLIS
PLATTEVILLE
JANESVILLE
MILTON
RACINE
MONROE
BELOIT
ELKHORN
KENOSHA

Source: Evans Associates. *Wisconsin Distance Education Technology Study*. Madison: Wisconsin Educational Communications Board, 1993, p. A-1.

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The regional networks envisioned in this statewide system interconnect geographically dispersed clusters of users to each other and to the state overlay network. Fiber optics is the recommended technology for these regional networks. However, microwave and ITFS technologies can be used as long as they do not limit the network's performance regionally or its ability to connect to the state overlay network. The *Wisconsin Distance Education Technology Study* points out the importance of coordination of technology choices and implementation plans at the state level because of the impact such decisions will have on regional networks.

Local networks will typically consist of technologies chosen for their cost and availability in the local community. Although fiber optics is identified as the best all-around technology choice, all other technologies—including satellite, ITFS, cable and broadcast television, and FM radio—can reasonably be employed in the local network. This study, however, stresses the importance of creating local networks that are compatible with both the regional and state networks.

In addition to the three-tiered network model, this study recommends the state take the initiative in developing, adopting, and disseminating comprehensive technical standards to which all local and regional networks must conform. This should be done to ensure that all networks are able to interconnect, and that substandard facilities will not be created. The study discourages networks designed exclusively by vendors.

The *Wisconsin Distance Education Technology Study* also recommends the state expand the centralized leasing role it already plays in the State Telephone System (STS) by including high capacity leasing for use in local and regional distance learning networks. The study also suggests the state form a pool of experts to provide learning institutions with technical assistance, as well as help in writing grants and proposals and negotiating contracts. These recommendations are designed to keep districts from entering into costly individual contracts and from creating systems that duplicate those already in existence.

The importance of this 1993 study is that it attempts to bring into focus all existing distance learning projects, technologies, and future proposals and give them a state perspective. It is recommended that each school district obtain a copy of this report from the WECB and review it carefully. Before being finalized, all district distance learning planners should consider the recommendations of this study.

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Instructional Telecommunications in Wisconsin

3

Introduction

This chapter takes a broad view of the potential uses and applications of technologies in instructional telecommunications. It also focuses on how these technologies are employed in education in Wisconsin and outlines the types of instruction they deliver. Among these new educational opportunities are

- low-enrollment courses,
- options for individualized education,
- sources of integrated learning practices in a wide range of subject areas,
- the ability to manage learner objectives and monitor student progress, and
- access to tools such as databases, electronic spreadsheets, word processors, and electronic simulators that help students in all geographic locations manage data in a sophisticated manner.

This wide range of instructional opportunities facilitates student access to information and enhances the ability to think, make decisions, and solve problems. These opportunities also give a student a chance to master skills needed in today's increasingly technical and sophisticated workplace.

The various technologies give teachers access to course material, content experts, and students they might not have had contact with in the past. New course materials may be integrated with the existing classroom curriculum; content experts can collaborate with teachers on new methods of managing the learning process; and interaction with students of diverse cultural, racial, linguistic, and geographic backgrounds can bring new perspectives to topics being studied. These materials, content experts, and students can be delivered to classrooms by telecommunications technologies whether they are located nearby, across the state or country, or even on the other side of the world.

A wide variety of technologies are used in instructional telecommunications. They include telephones and telephone lines; radio; broadcast, cable, and microwave television; computers with modems; fiber optics; and satellites.

Telephone lines deliver audio-only instruction and audiographics, which combines still pictures with sound. They can transmit data, sound, video, or any combination of these three forms of information. They can also transmit data between computers that have modems.

Radio has been a staple of distance learning in the state since the 1930s and continues to provide some instruction to students throughout Wisconsin. Television—whether broadcast, cable, satellite, or microwave—has delivered instruction in Wisconsin since the 1950s. Television can transmit audio and video signals, as well as some data to subscribers at specially equipped sites. And today television can even be a two-way, interactive medium, a development that has opened up many new possibilities for education.

Computers are important tools in instructional telecommunications. In the future they will become even more valuable and versatile as they evolve into multifunction performance platforms. With the addition of full-motion video cards, modems, and television and radio transceivers enabling computers to both send and receive signals, computers of the near future will operate in a stand-alone environment. They will be able to receive signals from a local television station or another source and show full-motion or compressed video on their screens. They will also be capable of receiving and playing stereo-quality audio on embedded speakers.

Software exists that can simultaneously relay the elements of data, video, and audio to one computer. The software uses one window of the computer for data and another for video, while relaying the audio along with the other two signals. Computers in the future will also be able to send data, reports, and possibly even audio messages to nearby radio modems. These radio modems will pick up the signals and transmit them to telephone lines that will carry them to their ultimate destination.

Fiber optics is a new form of technology that utilizes a minute glass tube and laser impulses to transmit voice, data, and full-motion and compressed video. Telephone and cable television companies are turning to fiber optics as an alternative to the conventional cable or copper wire that now carry their transmissions. These firms have found fiber optics to be superior because of its immense transmission capacity and its ability to transmit all types of instructional modes—voice, data, and full-motion video—on one medium.

Satellite dishes in schools today can only receive signals and not transmit them. This limits them to one-way forms of instructional telecommunications. But a new technology called VSAT (very small aperture terminal), already used by business, industry, and the military, can also be adapted for schools. Although smaller than satellite dishes that traditionally only received signals, a VSAT dish can transmit voice, data, and compressed video back to the satellite.

Video compression is a technology that reconfigures a video signal so more channels can be sent over the same electronic space. Compressed video differs from full-motion video in that only the changes in moving frames are captured and transmitted. The reconstituted image exhibits some motion but, depending on the capacity of the transmitters and receivers, the motion may appear somewhat irregular. The video images will resemble the newsreels of the 1920s, when cameras were not able to record at the speed necessary to project full motion. This effect occurs in compressed video technology because the moving areas of the image are only approximated.

In the future this technology will enable a cable television company to squeeze 500 channels into the same electronic space that now carries 52. Compression technology is also making it possible to transmit compressed video on common telephone wires, and will make it possible for satellite channels to be simultaneously divided into two, four, or eight channels.

Overview

The telecommunications infrastructure in the United States is divided into three parts. They are as follows:

- the long-haul or intercity segment to carry telecommunications traffic over long distances;
- the local distribution or metropolitan-area segment to deliver telecommunications traffic within a local area and provide connections to or from the long-haul segments; and
- the on-site segment to receive the telecommunications traffic at its final destination. Each segment of this infrastructure is changing at a different rate, and some of the components may be missing at any one of the three parts that make up the entire telecommunications system. (Gallagher and Hatfield, 1989)

The long-haul part of the education infrastructure could include satellites, long distance point-to-point microwave relay systems, telephone networks, and fiber optics networks. The local part could be composed of broadcast and cable television, ITFS (Instructional Television Fixed Service), low-power television, local telephone exchanges, and metropolitan-area fiber optics networks.

The on-site segment of the infrastructure could consist of coaxial cable, fiber optics, and regular telephone wires to distribute voice, data, and video signals throughout the building. It could also include televisions, telephones, computers with modems, facsimile (fax) machines, audiographics stations, and videocassette recorders (VCRs) to turn these signals into usable instructional material.

Daniel Hatfield is president and Lynne Gallagher a senior consultant for Hatfield Associates, a telecommunications consulting firm in Boulder, Colorado. They have identified four major technological trends that will affect the ability of schools to provide instructional telecommunications opportunities to their staff and students. They are

- digitization,
- "intelligent" telecommunications networks,
- integration of voice, data, and video on the same transmission system, and
- fiber optics.

Digitization. The first technological trend is the move toward total digitization of the entire telecommunications network. Digitization is the conversion of voice, data, and video signals to electronic "bits" identical to those already created by computer modems. (The term "bit" is short for binary digit and refers to the smallest unit of information a computer can process.) Consequently voice, data, and video will be able to travel together over the same network instead of as separate audio, video, and data signals. Digitization also will result in cheaper transmission costs because more "data streams" can be sent over the same network at the same time.

"Intelligent" Telecommunications Networks. The second trend in technology is the greatly increased use of machine-based "intelligence" within telecommunications networks themselves. Computers today can monitor and manage networks to greatly increase the speed at which they operate. This also makes it possible for national, local, and on-site networks to be programmed to meet, within limits, the service needs of users at any of the three levels in the telecommunications infrastructure.

For instance, on-site users will be able to change their internal networks to accommodate a new computer lab, but would not be able to reconfigure the local or national parts of the infrastructure. However, local and on-site networks could work together to streamline their services, and together they could influence the national part of the telecommunications infrastructure.

Integration of Voice, Data, and Video. The third trend is the integration of voice, data, and video traffic on common transmission systems that can ultimately deliver them all to the on-site network. Currently a separate system, network, or technology is needed to send the different signals for voice, data, and video. Integrated Services Digital Network (ISDN), the worldwide standard for digital telephony (transmission of speech or other sounds), is the most concrete example of this trend. ISDN has two levels of service, one that accommodates the two-way transmission of 144,000 bits per second and one that accommodates delivery of a total of 1.5 million bits per second.

The first level of ISDN can support the simultaneous transmission of two voice conversations, or one voice call and one high-speed data signal from a computer. The second level of service can handle the simultaneous transmission of 23 voice conversations. Video signals sent over this second level of ISDN are in the form of compressed video. Both levels of service can be transmitted by regular telephone wires. It should be noted that currently, without digitization, each regular telephone line can support only one two-way conversation or one data transmission between computers.

Fiber Optics. The fourth trend is the incorporation of fiber optics in the telecommunications infrastructure. Fiber optics is part of the national and local parts of the network and is also being considered for the on-site segment. Current fiber optics technology is so great that one line can transmit 64,512 voice channels, each supporting one telephone conversation. One fiber optics cable can also deliver 32,000 ISDN channels. Within a few years, upgraded transmission equipment will enable a fiber optics line to transmit 129,000 voice channels.

These four trends in technology have also been accompanied by developments in high-powered satellites and extremely efficient VSAT satellite dishes. When all of these trends are considered, it means that the capacity of the telecommunications infrastructure to provide access to a wide range of instructional opportunities and resources will be increased greatly in the near future.

Technology Use in Wisconsin

The use of various technologies for instruction in Wisconsin is not a new phenomenon. Radio, television, films and film strips, and audiotapes and cassettes have been handy tools for decades for instruction, for drill and practice, and to supplement teacher activities. The University of Wisconsin (UW) Extension's "Wisconsin School of the Air," for instance, has provided radio instruction in areas such as art, music appreciation, and science since the mid 1930s. Wisconsin Public Television has been airing instructional television programs for kindergarten through twelfth-grade students since the early 1970s. Films and film strips, audiotapes, and learning kits were integral components of the individually guided instruction classrooms of the late 1960s and early 1970s. Their common characteristic is that they are one-way instructional technologies that do not permit student interaction with the instructional content or the presenter.

Even two-way interactive technologies are not new to Wisconsin. The UW-Extension's Educational Teleconferencing Network (ETN) has provided instruction since 1965. The two-way audio communications network links 200 locations statewide and offers more than 300 course series annually. The UW-Madison's Engineering Professional Development (EPD) program has offered continuing engineering education courses over ETN for more than 25 years. Also, the Extension's WisLine telephone conferencing service links multiple locations over a 64-line conference bridge for statewide instructional programming, staff inservicing, and teleconferencing. In 1991 the UW-Extension installed a satellite dish in each county seat in Wisconsin to add satellite conferencing services to its extension and outreach capabilities.

Project CIRCUIT, one of the nation's first two-way interactive television distance learning systems, has operated in the Trempealeau County area since the late 1970s. CIRCUIT, an acronym for Curriculum Improvement Resulting from the Creative Utilization of Instructional Two-way Television, has been a model for many of today's fiber optics networks. Project CIRCUIT used cable television to link eight small rural school districts and make it possible for the network to offer courses each district could not support with its own resources.

Since the 1980s more than 20 ITFS microwave television systems have been constructed in Wisconsin. They provide one-way video and two-way live audio interaction between instructors and students.

Microwave television can also be used for two-way video and audio, as it is in the Spencer area by the Central Wisconsin Educational Telecommunications Network (CWETN). This network employs ITFS to provide interaction among instructors, students, and classes that serve three cooperative educational service agencies (CESAs).

However, fiber optics is the transmission technology in CESA 8's Embarrass River Valley Instructional Network Group (ERVING) Project, CESA 12's Northern Wisconsin Educational Communications System (NWECS), and CESA 5's South Central Instructional Communications Group (SCING). Other fiber optics-based, two-way networks are being developed throughout the state.

Types of Educational Opportunities

Instructional telecommunications technologies currently make available in Wisconsin a wide variety of educational opportunities. Among them are

- student courses,
- enrichment programs,
- collaboration,
- staff development,
- credit programs and degree programs, and
- community programming and continuing education.

Student Courses

Student courses are full-year or single-semester courses taught by a distance teacher. They can consist of a complete curriculum, including testing, and students usually receive grades for performance and participation. These courses are not normally available at the students' school. Although such classes are usually at the high school level, satellite systems are making some courses available for middle, junior high, and elementary students.

Student courses can be supported by print material, textbooks, computer software, and other media. Some courses have been made interactive through electronic keypad technology so students can reply instantly to pop quizzes and questions. Also, telephone lines with toll-free numbers let students talk directly to distance teachers or to students in other locations who are taking the same class. Most courses also offer tutorial services through a toll-free telephone number. Tutors can answer questions from students and assist them with drill and practice exercises.

Depending on the type of technology chosen by a school district, courses can originate from a site just down the road or from as far away as another state or country. For instance, satellite dishes at individual schools enable Wisconsin students to take courses in Japanese that originate in Nebraska and are delivered by the Satellite Educational Resources Consortium (SERC). Wisconsin students have also studied advanced placement (AP) American government in a course telecast from Stillwater, Oklahoma, by the Oklahoma State University Arts and Sciences Teleconferences Service (ASTS).

Instruction is also produced locally and shared in Wisconsin. Students in the central part of the state can take courses in Spanish and Russian taught by the UW-Extension on the two-way audio network operated by ETN. And an AP calculus course is available from the ITFS-based Northeast Wisconsin Telecommunications Education Consortium (NEWTEC) project in Green Bay.

Project CIRCUIT, for example, was developed to

- offer a wide spectrum of educational programs to students in participating schools,
- broaden social enrichment opportunities for students, while allowing each school to retain its individuality,
- avoid duplication of course and program offerings by participating schools, and
- better utilize the skills of specialized instructors while continuing to maintain efforts to meet Department of Public Instruction (DPI) instructional standards. (Mikunda, 1978)

As a result of this collaborative effort, students have experienced educational opportunities they would not have had otherwise. Classes have included four years of Spanish, two years of German and French, shorthand, digital electronics, and advanced mathematics. There has even been a course in advanced computer construction in which students built a working computer. The distance teachers, for the most part, are employed in one of the neighboring school districts rather than in a neighboring state.

ERVING offers districts a wide range of high school courses taught by teachers the member schools hire as a group. ERVING has provided students access to classes in AP calculus, AP psychology, AP English, French and Spanish 1 and 2, German 3 and 4, business law, human development, mythology, American Indian culture, education for employment, and remedial English for seniors. The American Indian culture course is taught by teachers and students from the Menominee Indian school and covers units on history, language, culture, and arts and crafts.

Student courses from national providers such as SERC can be received by satellite at one location and be retransmitted over a fiber optics network to all members. Interaction with these satellite courses is possible over long distance telephone lines through speaker phones, fax machines, and keypad response units. (Garrard, 1991)

Enrichment Programs

Instructional telecommunications can also help teachers provide enrichment and supplemental programs, additional resources, and new activities. Enrichment programs can be added to an existing curriculum as a way to investigate, discuss, and illustrate single issues or narrow topics in depth. The programs can be part of a series or stand alone in the discussion of a topic or issue. They are usually supported by a teacher's guide with suggestions on how to integrate the material into an existing curriculum.

For example, the "Exploring Technology Education" series on Wisconsin Public Television can supplement the curriculum for technology education classes in grades 7 through 10. It uses computer-enhanced graphics, animation, archival footage, and on-location segments to illustrate and reinforce abstract ideas in the fields of communications, construction, manufacturing, and energy.

A middle school class studying acid rain in its community as part of a unit on environmental science can take part in the National Geographic Society's Kids Network, a telecommunications-based science program involving computers. Students collect data with science kits, go on field trips, and work with computers to analyze the information and write reports. Students then use computers equipped with modems to send their findings to research partners in distant classrooms.

Middle school students can participate in "What's in the News," a weekly news program on public television that has social studies activities based on current events. The show has news summaries on the latest international and national events, and feature stories that examine timely, complex issues. Student activities include two essay contests and a "News Detective" segment that encourages students to clip newspaper articles or write their own stories about community events, school activities, or classroom projects. These stories are sometimes aired during the weekly programs.

High school social studies classes can augment their print-based texts and materials with public television series on taxes, geography, history, the U.S. Constitution and Supreme Court, or international issues. An example is CNN's "Newsroom," a daily 15-minute video news program on cable television. Additional content for this program is delivered by XPRESS XChange, a 24-hour-a-day text-based news service. This written material can be downloaded from the cable television signal to a computer at the school by using a specialized modem.

Programs on the state public television network address social issues of interest to teens and their parents. Community programs aired on regional technologies (such as ITFS) will often discuss topics of local or regional interest such as truancy, parenting skills, and human growth and development. Also available are Wisconsin Technical College System (WTCS) and UW-Extension programs.

Milwaukee School District (MSD), for example, uses instructional telecommunications to provide a range of enrichment opportunities to more than 150 schools. Four channels of ITFS are available to every classroom in this district, which serves nearly one fifth of all elementary and secondary students in the state. One of the four channels retransmits Elementary and Secondary Cable Consortium programming carried on the local educational cable channel, while another channel rebroadcasts Wisconsin Public Television Network shows from the "Parade of Programs." The two remaining channels air instruction chosen or created specifically for the MSD, such as teleconferences and special events not available from public television or the educational cable channel. Examples are National Aeronautics and Space Administration (NASA) offerings and teacher inservice programs from SERC, the National Diffusion Network, and other K-12 providers.

Technology can also help create extracurricular student activities. For example, several CESAs conduct a "High School Quiz Bowl" over a telephone convener system and regular telephone lines. Each participating school has one team of four players and the teams compete during the course of a "season," answering knowledge-based, short-answer questions purchased from an academic company. A moderator asks the questions, monitors the answers, and handles the scoring.

Internet has quickly become a rich source of enrichment programs for Wisconsin students. Internet has more than 12 million users in 56 countries and every continent, including Antarctica, and it connects more than 60,000 separate networks. Electronic mail allows students in various countries to communicate or to collaborate on joint projects. Students and teachers use Internet to access databases and library catalogues located around the world and to engage in electronic group discussions on a wide variety of topics.

Belleville students have used Internet to communicate with their counterparts in Helsinki, Finland. Activities have included exchanging collaboratively written assignments and stories about the lives of children in their respective countries. Students even accessed the computer network to hold live, interactive video "meetings."

Middle school students in Menomonee Falls have practiced their writing skills by communicating with electronic "pen pals" worldwide through Internet. These students have also worked with classes in other countries to co-author a story involving dinosaurs and a group of adventurous scientists. Students also utilize Internet to gather and share information with scientists, students, and environmentalists around the world and to engage in many other joint activities. The involvement by West Salem Middle School students in The World School for Adventure Learning, which was explained in chapter 1, is an example of the way Wisconsin schools can share a learning experience with students in other countries.

Collaboration

Collaboration occurs when a teacher works with one or more colleagues or content experts to instruct students in a given subject area, or across several subject areas. Collaboration also occurs when technology links students with other teachers, classrooms, and content experts outside the school. For example, classroom teachers, their students, and professional scientists collaborate with one another within Kids

Network, a telecommunications-based elementary school science program produced by the National Geographic Society. Massachusetts Institute of Technology physicist Robert Tinker developed Kids Network to extend to schools the concept of electronic mail sent by computer and modem, a primary means of communication today for scientists. Kids Network has made it possible for thousands of upper elementary school classrooms, including some in Wisconsin, to participate in research projects on acid rain, weather, waste management, and other topics. Each project is guided by a practicing scientist, who uses electronic mail to coordinate the collaboration among classrooms.

Another example of collaboration was the Wisconsin Science, Mathematics, and Technology Education (WISMATE) Network Project, based in the Wausau school district. Fifth-graders, their teachers, and Wisconsin-based scientists and engineers worked together on subjects of local interest, such as applications of biotechnology in the dairy industry.

Although many of the current collaborative networks have a science content, the programs have interdisciplinary features. For example, doing research on topics for which clear, "right" answers do not exist can help students develop and learn to apply critical thinking skills to solve real problems. Students also acquire computer skills because they must use word processing programs to enter data, observations, and information on the computer network. In doing their reports, students find that clear communication and precise use of language are critical for success. This can aid development of the critical skill of communication. When students have to analyze data, they need to use mathematics. They practice these skills and also discover that math is a useful tool. Skills in geography and social studies are sharpened as students exchange messages with their electronic pen pals and study the areas where they live. Teachers who have been involved in telecommunications-based programs have commented that they are truly interdisciplinary and exciting for children.

Staff Development

Instruction over these technologies also includes staff development and continuing education programs and courses. Staff development programs typically are shorter than a full course and have a narrower content focus. A program can be a single-event teleworkshop from one to several hours long (but usually not more than three hours) or a series of several one-hour to two-hour programs focused on the same topic. Equivalency clock hours (ECHs) toward recertification in Wisconsin may be awarded to participants in pre-approved inservice series that are more than five hours long. These programs can originate locally, regionally, or nationally.

Staff development programs and teleworkshops are mostly live and interactive, with participants able to call during the program on toll-free numbers. However, such shows can also be viewed later on videotape.

SERC, for example, annually provides approximately 100 hours of live and interactive staff development programs over its national satellite system. Topics include building self-esteem among teachers and students, identifying and programming talented minority students, discipline-based art education workshops, technology education, earth science, English as a second language, and bilingual education for teachers and administrators. Business and industry can send employees to UW System or WTCS campuses to participate in the satellite-based National University Teleconference Network (NUTN). Employees can receive training or updates on important economic, environmental, and technical developments.

The North Central Regional Educational Lab (NCREL), in conjunction with Public Broadcasting System (PBS), has offered national television series over satellite on educational reform and successful schools. Both SERC and NCREL programs are supported by print material and an electronic bulletin board. The latter enables extended discussions over computers long after the telecast.

Staff development and continuing education courses are provided statewide over the ETN audio conferencing network and regionally over ITFS systems. NEWTEC in Green Bay uses ITFS to offer staff development programs produced by local teachers and university faculty. NEWTEC also rebroadcasts nationally produced programs recorded from satellite transmissions. To accomplish these tasks, NEWTEC engages in extensive interinstitutional cooperation and program planning among K-12 schools, CESA 7, Northeastern Wisconsin In-School Telecommunications (NEWIST), and local postsecondary institutions. Professional staff development programs from the Green Bay School District's professional development department and CESA 7's special education department are aired weekly. Workshops from CESA 7's Fallen Timbers Environmental Center are presented periodically. National professional development teleconferences from SERC, NASA, and other national providers can be downlinked and retransmitted live, or taped for later broadcast. (Nys, 1990)

Credit Courses and Degree Programs

Credit courses can be graduate, undergraduate, or associate degree courses offered alone or as part of a degree program from local, regional, and national sources. UW-Madison's School of Education uses ITFS to provide 17 school districts in the Madison area with graduate-level courses on critical thinking skills. UW-Madison's College of Engineering has chosen satellite technology to send graduate-level courses over National Technological University (NTU). UW-Milwaukee operates an ITFS system to deliver courses to several industrial work sites in the greater Milwaukee metropolitan area. It also employs audiographics to offer graduate-level courses statewide from some of its individual colleges. UW-Stevens Point has broadcast credit courses over ITFS on the philosophical foundations of education, the Hmong culture, and dietetics.

Credit courses can be taken from national satellite providers. SERC, for instance, offers several courses to teachers in Wisconsin and 23 other states. They include an AP calculus course for teachers from South Carolina, an introductory course on English as a second language from Louisiana, and two "hands-on" chemistry- and math-in-the-classroom courses produced in Wisconsin.

The WTCS offers approximately ten telecourses each semester statewide on the Wisconsin Public Television Network. Thirteen WTCS districts use cable television and nine ITFS or point-to-point microwave technologies to deliver instruction, both on and off their campuses. Courses are in the areas of business, communications, technical skills, child care, and General Educational Development (GED) preparation. The instruction is also available on videocassette. WTCS enrolls almost 6,000 students annually in classes taught through these mediums.

Community Programming and Continuing Education

Noncredit continuing education courses for adults are often delivered by instructional telecommunications technologies. This enables sponsoring agencies to reach their audiences more efficiently and to provide adults with up-to-date information needed to keep them current in their fields of employment or expertise. Organizations often use continuing education courses to license or certify people in real estate, child care, cardiopulmonary resuscitation (CPR) and first aid, food service, nursing, and other fields. These courses can also introduce new techniques, technology, computer software, and leadership skills.

The Wisconsin Dental Association (WDA) has employed satellite video conferencing to educate state dentists on new federal Occupational Safety and Health Administration requirements. With satellite equipment and an audio conferencing network, the WDA has been able to reach more than 500 dentists statewide in a single seminar.

Northcentral Technical College (NTC) in Wausau has offered a 20-hour continuing education wellness course for the elderly. The college's ITFS system has made this instruction available to hundreds of older adults at community nutrition sites in the Wausau area. Programs were presented by family physicians, lawyers, nutritionists, and physical therapists.

Southwest Wisconsin Technical College of the Air has presented continuing education courses on federal acreage reduction programs, feed grain, farm income tax management, and patients' rights and the power of attorney. The college has also used its ITFS system to produce a two-day community-event telethon that benefitted citizens in southwestern Wisconsin.

The Madison Metropolitan School District has created a variety of community programs and adult education courses for its cable television channel. Community programming in a typical month could include a musical program from an elementary school, a poetry festival from a high school, and swim meets. Viewers might also be able to see a series discussing current district policies on such topics as acquired immune deficiency syndrome (AIDS), building space use, or a tutoring program. Public service programs on suicide prevention, racism, and gifted and talented projects might also be part of just one month's community programming.

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Technologies Used 4

Introduction

This chapter presents an overview of instructional telecommunications technologies in Wisconsin, analyzing the characteristics of each technology and giving examples of their instructional uses. However, it is not meant to be an exhaustive treatise on each technology. It will also not discuss how to link technology to curriculum goals, because the instructional resources needed to reach these goals will vary from building to building and district to district. Resources are provided so those who are interested may obtain more detailed information about each technology.

Technology and Instruction

The particular technology chosen for instructional telecommunications can be both enabling and limiting. It is enabling in that it can bring students and teachers together in new and exciting learning situations. It is limiting in that a particular technology may not permit or facilitate some types of education.

Instruction involves a complex set of decisions, interactions, strategies, and learner support systems that include content, reinforcement, motivation, learning styles, and teaching strategies. Technology may enhance or hinder any of these parts of the instructional process. For instance, an audio conferencing network will facilitate study of a foreign language because of the nature of the subject matter, but would hinder instruction in art or auto mechanics because of the inability to provide visuals needed to teach these classes. A computer with a modem is excellent for accessing databases, information, and other students and teachers around the globe. But it is a poor way to teach a foreign language because it cannot provide audio so students can hear how the language should sound. A national satellite system is an economical way to deliver low-enrollment classes to a large number of small, rural schools in North America. However, it would be an expensive way to teach the history of Wisconsin to all fourth graders in the state. Also, because the satellite signal would be sent to all of North America, it would be a waste of time and of the channel used for that purpose.

A few basic steps will help school districts decide which instructional telecommunications technologies will be right for them. They are as follows:

- School districts should assess instructional needs before either purchasing a new technology or adopting a course to be taught over available technology.
- School districts should decide whether they can meet their instructional needs from local, regional, state, or national educational resources. For instance, if a district wants to offer advanced placement (AP) chemistry to its students, should it bring in a nationally offered course via satellite? Or would it be better to use Instructional Television Fixed Service (ITFS) or fiber optics to transmit this course from a local University of Wisconsin (UW) System campus or neighboring school district?

- Finally, school districts must relate the costs of each technology to specific instructional needs.

Types of Telecommunications Technologies

In Wisconsin, a variety of telecommunications technologies currently deliver voice, data, and video to classrooms for instructional purposes. (See figure 4) Each of these technologies has its own characteristics that dictate the type of content material and specific methodology a teacher can use to instruct students. For instance, a teacher in an audio-only telephone network can play an audio tape, but would be unable to incorporate graphics into the instruction. A computer conferencing network can facilitate learning with data, graphics, and printed material, but cannot utilize audio or video. Although they do not today, in the future computers will have the capability of sending and receiving audio and video.

Many of the technologies employed in instructional telecommunications can be used together to minimize the weaknesses and maximize the strengths of each. Combining different technologies will expose students to the broadest set of teaching methods and enable them to derive the greatest instructional benefits.

Telecommunications technologies currently in use are

- telephone wires,
- radio,
- broadcast television,
- microwave television or ITFS,
- cable television,
- videotext and teletext,
- satellite, and
- fiber optics.

Telephone Wires

The telephone has only been in existence for slightly more than a century, but in that time has evolved into a sophisticated global network that is the world's standard means of communication. Currently there are approximately 400 million telephones in more than 200 countries, all operating on what is essentially a single network connecting the world. This global telephone system is sometimes called the "largest machine in the world." It carries about 400 billion conversations annually, a volume that is increasing at the rate of 20 percent every year. By the end of this century it is estimated there will be more than 1.5 billion telephones, and they will be used to make more than one trillion calls annually. (Dordick, 1989)

Telephone wires can transmit voice, data, and video signals. The video, however, is in the form of still pictures or partial-motion pictures as opposed to the full-motion, picture-quality video a television can receive and show. In the future, video compression technology will enable transmission over telephone lines of full or nearly full-motion video. Telephone wires consist of twisted pairs of copper wires that transfer electrical impulses. These impulses are then turned into audio sounds, data bytes, or still pictures, depending on the form of technology at the receiving end. Telephone traffic is also carried over satellites and fiber optics systems, technologies that will be discussed later in this chapter. Basic telephone technology is by far the most prevalent form of telecommunications, available in over 97 percent of all residences in the United States and virtually 100 percent of all businesses throughout the world.

Wisconsin state government has an extensive telephone network that provides a variety of telecommunications services to state agencies, local governments, and schools. Figure 5 shows the configuration of Wisconsin's Centrex voice service and state telephone backbone. Figure 6 shows the configuration of Wisconsin's data network which enables several state agencies to send and receive data. The state lottery, although only a few years old, is by far the largest user of this data network.

Telephone lines can be the main delivery technology for several kinds of instructional telecommunications including audio conferencing, computer conferencing, and audiographics. In addition, telephone lines can be a supplemental technology to other forms of instructional telecommunications.

Computers equipped with modems can communicate data, information files, graphics, and electronic mail (e-mail) to other computers. Facsimile (fax) machines transfer data, words, graphics, and pictures to printers at remote locations. Audiographics combines live audio lectures with the transmission of graphics via computer. A printer may be attached to this system to make a hard copy of any graphics displayed on the computer screen during the course of the

Figure 4

Types of Instructional Telecommunications

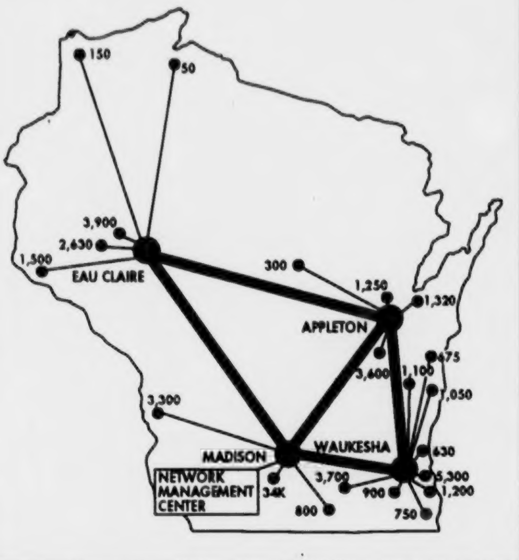
Telecommunications Technology	Form of Instructional Telecommunications	Coverage Range	Level of Interactivity
Telephone Wires	**Audio Conferencing**—Students and teachers can interact over the shared audio network in a full-credit class, enrichment program, and other distance learning experiences.	Unlimited; users can be linked all the way to the international level.	Two-way transmission of audio; print material via fax optional on a second telephone line
	Computer Conferencing—Computers with modems enable students/teachers to obtain information from remote databases and other sources, communicate with their counterparts in remote locations, and engage in collaborative learning ventures and other distance learning experiences.	Unlimited; users can be linked all the way to the international level.	Transmission of data is usually one-way; simultaneous, real-time, two-way transmission is possible.
	Audiographics—Teachers and students can communicate verbally on an audio line and exchange data, including graphics, through computers in a full-credit course, enrichment program, and other distance learning experiences.	Unlimited; sites with specialized equipment can be linked all the way to the international level.	Two-way voice, data, and graphics transmission
Radio	**Educational Programming**—Some commercial stations carry news specials and other shows that might be used in the classroom; the Wisconsin Public Radio Network and School Radio Service provide educational programming, including full-credit courses.	Dependent on an individual station's signal strength and quality of reception; local stations in the Wisconsin Public Radio Network serve virtually the entire state.	One-way audio; sometimes two-way audio interaction via telephone
Broadcast Television	**Commercial Television**—Some programming can be used in the classroom, mainly as a source of enrichment to a curriculum or subject area.	About 60 miles for a local station, depending on signal strength and quality of reception	One-way audio and video transmission
	Wisconsin Public Television—Programs are designed for education, including full-credit courses, enrichment programs, and other distance learning experiences.	Local stations in the Wisconsin Public Television Network serve virtually the entire state.	Mainly one-way audio and video, but some programs have two-way audio interaction via telephone.
	Low-Power Television—Full-credit courses, enrichment programs, and other distance learning experiences	Up to 15 miles depending on signal strength and quality of reception	One-way audio and video, but some programs have two-way audio interaction via telephone.
Microwave Television	**Instructional Television Fixed Service (ITFS)**—This interactive technology can be used for full-credit courses, enrichment programs, and other distance learning experiences.	Up to 30 miles depending on reception for this line-of-sight signal transmission; omnidirectional or point-to-point	Usually one-way video and two-way audio transmission; it can be designed for two-way video and audio.

Figure 4 (continued)

Types of Instructional Telecommunications			
Telecommunications Technology	**Form of Instructional Telecommunications**	**Coverage Range**	**Level of Interactivity**
Microwave Television (continued)	**Point-to-Point Microwave**—This interactive technology can be used for full-credit courses, enrichment programs, and other distance learning experiences.	Up to 30 miles depending on reception for this line-of-sight signal transmission	Usually one-way video and two-way audio transmission; it can be designed for two-way video and audio.
Cable Television	**Educational Programming**—Commercial channels generally have limited programming for use in education but several, like Public Broadcasting System (PBS) and Discovery channels, carry many usable shows; local dedicated channels (those set aside specifically for education, government, and community use) may run programming designed for education.	Up to 30 miles depending on the size of the cable television system; however, some areas are not served by cable companies.	One-way audio and video for commercial stations; dedicated channels may be designed for two-way audio and video by using one or more available channels.
Broadcast or Cable Television	**Teletext**—Transmits constantly changing data such as stock market quotations and weather reports that can be a class resource.	Same as for the television system delivering it	One-way data transmission over a television set's vertical blanking interval, which is the black bar at the top of the TV screen
	Videotext—Can provide computer-aided instruction.	Same as for the television system delivering it	Two-way data and color graphics transmission over a television set's vertical blanking interval, which is the black bar at the top of the TV screen
Satellite	**Educational Programming**—Full-credit courses, enrichment programs, conferences, and other distance learning experiences are available.	A satellite signal covers one-half of the earth at the same time.	One-way video and audio transmission is the norm, but a system can be designed to add two-way audio, two-way data, or even two-way audio and video.
Fiber Optics	**Educational Experiences**—Fiber optics has the capability to transmit any kind of instruction or educational experience; because of its capacity, it is considered by many as the preferred telecommunications technology of the future.	Up to 20 miles without signal repeaters, much further with repeaters	Two-way voice, video, and data transmission

Figure 5

Wisconsin Voice Network


150
50
3,900
2,630
1,500
EAU CLAIRE
300
1,250
1,320
APPLETON
475
3,600
1,100
1,050
3,300
MADISON
WAUKESHA
630
NETWORK MANAGEMENT CENTER
34K
3,700
900
5,300
1,200
800
750

Source: Evans Associates. *Wisconsin Distance Education Technology Study*. Madison: Wisconsin Educational Communications Board, 1993, p. D-8.

lesson. An audio cassette recorder can also tape the lecture for later review. These forms of instruction are all made possible by telephone communications.

Audio Conferencing Networks

Equipment needed to set up an audio conferencing network for a school includes

- a speaker telephone with mute button,
- a push-to-talk convener box (optional),
- audio cassette player and audio tapes to record lessons,
- a dedicated telephone line (recommended),
- a fax machine (optional),
- a computer with modem (optional), and
- slow-scan picture equipment (optional).

Audio conferencing is made possible by linking individuals at several sites through telephone circuits and is analogous to creating a large party line. It can be an "audio only" network over which instructors and learners can hear and speak to each other simultaneously.

When combined with computers and equipment to display graphics, the audio line becomes an audiographics network enabling instructors and learners to simultaneously hear each other and see graphics or still pictures. When audio conferencing is the feedback loop for one-way video networks such as broadcast and cable television, ITFS, and satellite, the student can see and hear the instructor and the instructor can hear the student.

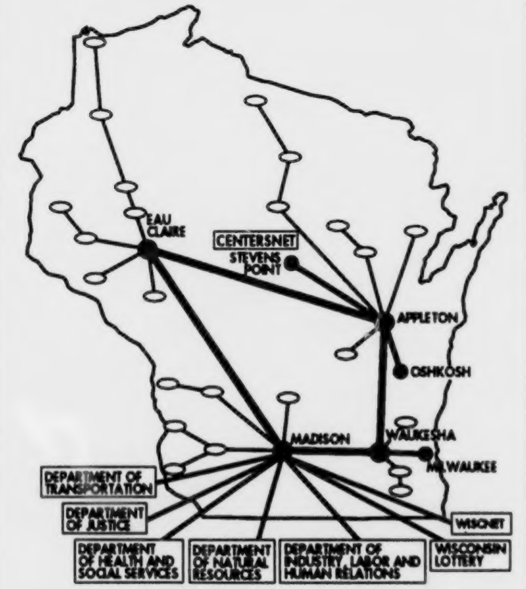
Modes of Instruction

The primary mode of instruction in audio conferencing is two-way audio, which enables teachers and students to interact over the network. Assignments, quizzes, exams, and student records can be exchanged through the mail. If graphics technology is part of the audio conferencing system, one-way video instruction in the form of pictures, graphics, or charts can be transmitted from the instructor to the learner.

If computer or fax technologies are added, two-way data interaction can occur among all parties on the network. (See figure 7) Most audio conferencing, however, is audio only. (See

Figure 6

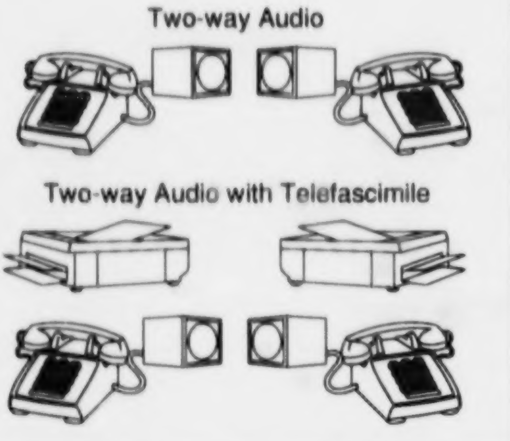
Wisconsin Consolidated Data Network


EAU CLAIRE
CENTERSNET
STEVENS POINT
APPLETON
OSHKOSH
MADISON
WAUKESHA
MILWAUKEE
DEPARTMENT OF TRANSPORTATION
DEPARTMENT OF JUSTICE
DEPARTMENT OF HEALTH AND SOCIAL SERVICES
DEPARTMENT OF NATURAL RESOURCES
DEPARTMENT OF INDUSTRY, LABOR AND HUMAN RELATIONS
WISCNET
WISCONSIN LOTTERY

Source: Evans Associates. *Wisconsin Distance Education Technology Study*. Madison: Wisconsin Educational Communications Board, 1993, p. D-9.

Figure 7

Audio Conferencing



Source: Office of Technology Assessment. *Linking for Learning: A New Course for Education*. Washington, DC: U.S. Government Printing Office, 1989, p. 56.

the sections later in this chapter on audiographics and videotext for information on technologies that allow delivery over telephone wires of a combination of data, graphics or images, and audio communications.)

The advantages of using audio conferencing technologies for instruction are as follows:

- Students can hear and interact with the teacher and other students at all times.
- Operation of this technology is relatively simple.
- This technology is available statewide and is not expensive to acquire or operate.
- It does not cost much to expand the audio network.
- Instruction can come from any of the participating sites, so each school on the network can offer courses as well as receive them.

There are some disadvantages to audio conferencing. They are as follows:

- Students and teachers cannot see each other.
- Textbooks, reference articles, quizzes, and other class materials must be coordinated so they can be sent to each site in time to be used and reviewed.
- Classrooms must be equipped with the audio equipment, which means a separate room in the school may have to be set aside for this network.
- Class schedules, school calendars, and dates to begin and end the course will not necessarily correspond with local schedules and calendars. (Barker, 1992)

Computer Conferencing

In order to engage in computer conferencing for instructional purposes, a school will need

- a computer, or computers, each equipped with a modem with a baud rate of at least 2,400 to 14,400,
- communications software,
- a printer (optional), and
- a telephone line.

Computers equipped with modems are able to communicate over telephone lines. The smallest amount of information a computer can process is called a bit and computers store information in units called bytes. A byte is usually made up of a group of eight bits. A modem—the common term for Modulator/Demodulator—changes the computer's internal bytes into electronic impulses and transmits them as "sound" over telephone wires. Modems work at different speeds of communication, called baud rates. The baud rate refers to the number of bits per second that can be transmitted. Thus, the higher the baud rate, the more bits of information the modem can process in a single second.

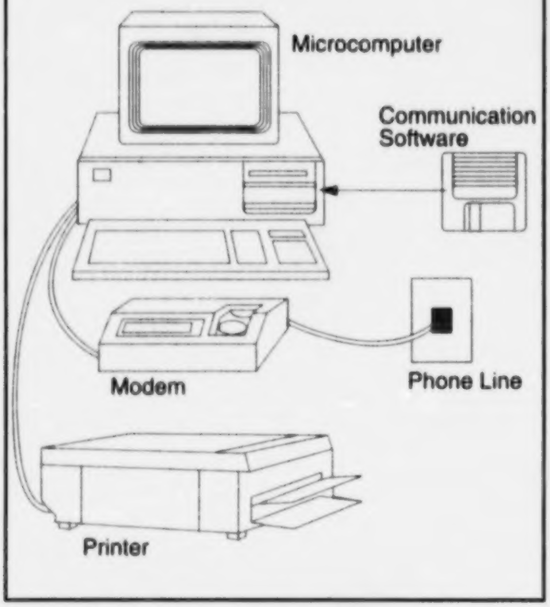
Common baud rates are 300, 1,200, 2,400, 9,600, and 14,400. Modem speeds, however, are increasing rapidly and baud rates of 2,400 and higher are usually preferred. A modem with a higher baud rate is more expensive to purchase, but may be worth the extra cost if the buyer frequently accesses distant databases and has to pay for telephone charges during data exchange. Modems with higher baud rates reduce telephone bills by cutting the time needed to send or receive information. (See figure 8)

Computer telecommunications can create a wide variety of new learning opportunities for students. With this technology, they can communicate with "pen pals" in distant countries or contact experts and teachers from around the world. Some online services provide activities to enhance classroom instruction in a specific curriculum or subject area, while others enable students to look up needed information.

For teachers, the opportunities derived from computer telecommunications are also vast. This technology makes it possible for teachers in widely separated areas to communicate and

Figure 8

Equipment Needed for Computer Communications



Source: Alley, Cindy, et al. *Online Database Searching in the Curriculum*. Madison: Wisconsin Educational Media Association, 1986, p. 10.

share information and experiences. Teachers can conduct research in online databases, download software, and link with groups that share special interests.

"Electronic mail" (e-mail) is one way to send and receive messages over computers. Each subscriber to an electronic bulletin board service (bbs) has an "address" to which other subscribers can "mail" their messages. A bbs is a public medium to post information, a type of electronic bulletin board. Subscribers can send messages and read responses of others active in the bbs. Some of these services have a theme so people with special interests can share information. Some charge a small fee while others are free.

One of the most important and all-encompassing online computer services is Internet. Started in the late 1960s by the U.S. Defense Department, it was used to transmit data among researchers engaged in defense-related projects and to test fault-tolerant communications systems built to survive a nuclear attack. Internet today connects more than 12 million people in 56 countries and provides a wide range of services, many of them valuable to educators. Internet, as well as other online services and networks, is discussed more fully in appendix B.

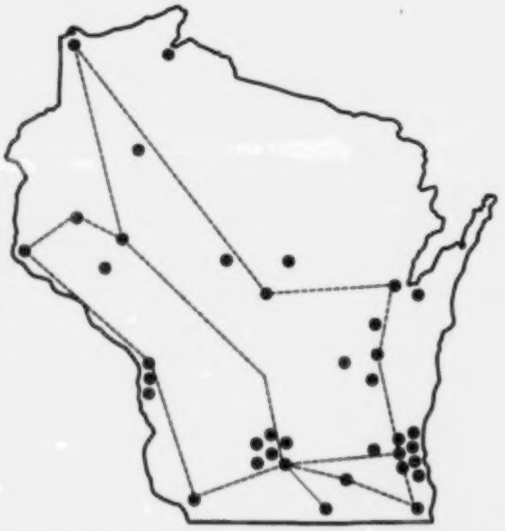
WiscNet, a nonprofit association formed by the UW System, is a major gateway to Internet for UW campuses and many other state colleges and schools. Figure 9 is a map of the WiscNet system in Wisconsin.

Computers can also access online databases. Online services may consist of referral or bibliographic information to help locate an entire article or document. Some referral databases contain abstracts of the desired material, while others consist of source or non-bibliographic information. Full-service databases have full-text documents complete with text, data tables, graphics, references, and indexes. There are even databases that provide raw numerical data that can serve as purely informational items or base material for further research. (Epler, 1989)

Computer-based telecommunications can create, in effect, a global classroom in which students and teachers can communicate with their peers around the world. Computers with modems can exchange messages with computers in other locations, store them for possible later use,

Figure 9

WiscNet: Wisconsin Network Linking Educational Institutions



Source: University of Wisconsin-Extension, 1993.

or relay them to other computers. This mode of communication is known as computer conferencing. A systems operator or moderator usually coordinates such computer discussions. A variety of computer-mediated conferencing systems enable all members to communicate without having to be online at the same time.

Computer conferencing can take the form of cultural exchanges in which global participants share and compare information about each class or school involved. Graham Pike and David Selby, research fellows at the Centre for Global Education at the University of York, Great Britain, have published a useful handbook for teachers titled *Global Teacher, Global Learner*. The guide explores and discusses the theory and practice of global education. It also offers an extensive range of practical activities for elementary and secondary classrooms. (Pike and Selby, 1988)

Other computer-based communications are in the form of directed study. For instance, students can gather, analyze, and report environmental data, or they can collaborate on writing poetry, short stories, and reports. Students, via computer, can engage in geopolitical, historical, and economic simulations in which participants take on the roles of various factions in a current world conflict. They can then try to resolve the problem by discussing and analyzing real data and issues. Of the many bulletin boards listed in appendix B, several have active global classroom components, including AT&T Learning Network, DataTimes, GEMNET, GTE Education Network, Interactive Communication Simulations (ICS), National Geographic Society's Kids Network, and XPRESS XChange.

Computer conferencing is also a major communications tool in education. Computers are capable of linking students and teachers with online library catalogues, online databases, curriculum discussion groups, subject matter experts, and research projects nationally, regionally, and locally. Several electronic bulletin boards and networks in Wisconsin can facilitate these communication activities.

Modes of Instruction

The primary mode of instruction with computers is one-way data transfer. Data may be in the form of messages, documents, and other forms of information that, for the most part, are read online or downloaded into the computer for later attention. New computer software is making possible real-time, two-way data communication over a split computer screen on which the instructor and student can see typed messages from each other simultaneously and side-by-side. This mode of computer conferencing is called "chat" mode. Future innovations in software and high-capacity telephone services will also turn computers into audiographics terminals. Users will be able to send and receive documents, view computer conference participants via compressed video, and talk with them over the computer's built-in speaker system.

Advantages of using computer technologies for instruction are as follows:

- Students and teachers have access to a wide array of computer-based resources, including online databases, electronic mail, and bulletin boards.
- Students and teachers can also access word processing, graphics, and desktop publishing packages to help them create reports, books, and assignments from the resources they have gathered.
- Students and teachers have fairly easy access to computers because practically every school has them.
- Computers are relatively inexpensive to acquire and operate, and many students and teachers already own them.
- Instructional material and communications can be dealt with immediately or they can be left on disk or electronic bulletin boards to be read or used later.
- Many students and teachers already know how to operate this technology.
- A large number of electronic resources exist that can be used instructionally.
- With full-motion video cards, modems, faxes, and CD-ROM players, computers in the future will be the technology platform upon which any and all types of instruction and communication can and will take place.

Disadvantages of computer-based technologies for instruction are as follows:

- Only one or two students and teachers can effectively use a computer at one time, so schools need to have a relatively large number available.
- Not every classroom has computers.
- Not every computer has a modem.
- Not every school allows students and teachers to conduct online activities due to the cost

for subscription fees and long-distance telephone bills.

- Not every school has a secured or dedicated telephone line for data transmissions accessible by students or teachers.
- Not every school has teachers trained to use computers for telecommunications.
- Not every school has computers sufficiently powerful to participate in today's computer environment.

Audiographics

Equipment needed to use audiographics conferencing for instruction and other purposes includes

- 386- and 486-level computers with hard drives that have more than 80 megabyte capacity;
- high-resolution monitors;
- modems with baud rates of at least 14,400;
- two regular telephone lines, one each for voice and data;
- *summagraphics* digitizing tables (optional);
- a scanner to copy pictures, graphics, or text directly into the computer (optional); and
- a video camera (optional).

Audiographics conferencing connects teachers with students through a combination of computer and voice telecommunications. Voice and computer screen images, including text, data, and high-resolution graphics, are transmitted live to participants at multiple remote locations. Students can respond to visual material shown on their computer monitors and engage in discussions over a telephone speaker system. (See figure 10)

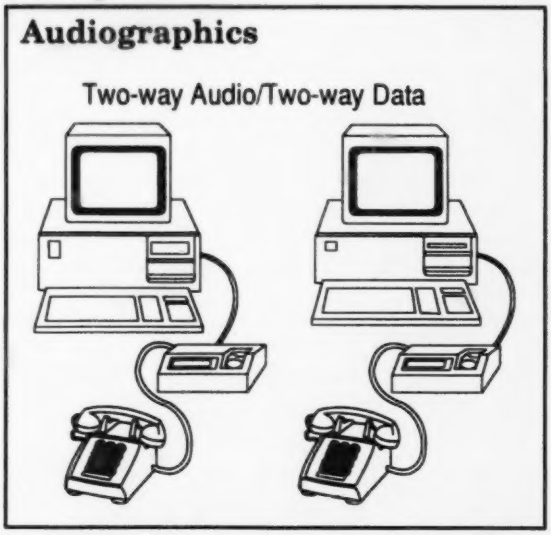
A device called an audio bridge enables students in participating classrooms to hear each other, much as they would with two-way television. Students also can communicate via computers linked to the teacher's machine by modem and specially designed software. Whatever is put into the teacher's computer simultaneously appears on all screens in the networked classrooms. In effect, this makes the screen an "electronic blackboard."

New, more powerful audiographics systems can display still images but not moving pictures. However, the interactive capability, high-resolution display, ease of use, and ability to reach any location with telephone lines, all make modern audiographics a viable alternative to interactive television. And audiographics can be operated at a fraction of the cost. If motion video is required, audiographics systems can be used in tandem with any video transmission system, with the video then being displayed on an ordinary television screen. In the future, multimedia software is expected to be able to deliver compressed video to a window in the audiographics display screen. However, that technology is not currently available. (Smith, 1992)

Graphic information can come from the keyboard, graphics tablet, document scanner, video camera, or electronic pencil or stylus of either the instructor or the students. The stylus enables students in remote sites to edit or expand visual material interactively, because all screens on the network display the "electronic writing" simultaneously. This technology also permits a user at any remote site to input visual materials originating on his or her own computer. A laser printer complements the system and provides printed copies of the visual display material.

The UW-Madison's Department of Engineering uses audiographics conferencing to deliver graduate-level and continuing education courses to engineering and technical professionals. Each semester the department has employed audiographics to offer 20 to 40 different courses to students throughout the U.S., Canada, Mexico, and Europe. Instructors from Europe and

Figure 10



Source: Office of Technology Assessment. *Linking for Learning: A New Course for Education*. Washington, DC: U.S. Government Printing Office, 1989, p. 56.

Japan have taught over the system. The locations for these classes have included public sites at UW campuses and more than 50 workplaces in private industry. The courses have centered on manufacturing, environmental engineering, building design and construction, and technical languages in Japanese and German. (Smith, 1992)

The UW-Extension's Instructional Communications Systems (ICS) provide management and technical support for a service called WisView. This audiographics network combines interactive audio conferencing with visual computer graphics to offer several courses to approximately ten UW campuses. This network can be expanded to other locations, both public and private. See figure 11 for the location of WisView sites around the state.

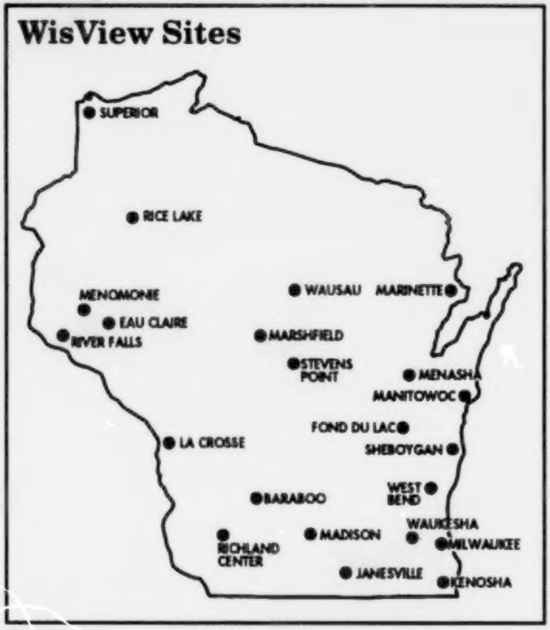
Modes of Instruction

The primary modes of instruction with audiographics are two-way audio, freeze-frame video, and data transfer. All three modes are simultaneously available to all parties on the network, and all participants can input into the network in all three modes from their classroom sites. The video consists of pictures, graphics, and charts. Data transmission over the computers, even directly on the screen with an electronic stylus, occurs in two-way, real-time modes. The transmissions can be stored in the computer as text, data, or graphics. Hard copies can also be printed from the screen for later use.

Advantages of using audiographics technologies include the following:

- Local schools maintain control of the master teacher, programming, and scheduling because the network is usually small.
- Small class size is guaranteed because this type of technology does not permit linkage with more than a few sites simultaneously.
- The system supports student-to-student interaction between sites, in addition to teacher-to-student interaction.
- Hardware, software, and maintenance costs are low, with start-up costs of between $6,000 and $13,000 per school. There are usually no subscription fees for courses, with telephone connect and toll charges usually constituting the only ongoing expenses.
- It is relatively simple to learn to operate such a system.

Figure 11



WisView Sites

Source: University of Wisconsin-Extension, 1993.

- Instruction can come from any participating site, so each school on the network can offer courses as well as receive them.
- The computer- or electronic chalkboard-generated visuals can be activated and accessed by the teacher as well as any student at any remote site, permitting a high level of interaction between students and teachers.
- Instructional content is focused more on the organization of the material than on the personality of the teacher.
- The network operates over regular telephone lines, so linkages between distant sites can easily be made almost anywhere in the world.

Disadvantages of using audiographics technologies include the following:

- Motion video is not possible, so visuals are displayed on the computer screen in still-picture or freeze-frame mode.
- The instructor cannot see the student, nor can students see the instructor or other students at distant sites.
- Occasional transmission failures occur due to interference on telephone lines.
- The video image is limited to the size of the computer screen unless additional hardware is added, including a large-screen television monitor or liquid crystal display (LCD) projector.

- Lesson planning is time-consuming for the teacher and floppy disks that store slides created for each lesson must be distributed to all remote sites and loaded into networked computers prior to the class.
- Telephone toll charges can become excessive unless networks have access to low-cost lines.
- Managing an audiographics network requires a commitment by local school administrators, and teachers need training and extra time to prepare materials. (Barker, 1992)

Radio

Equipment needed so classes can receive instruction via radio includes

- a special FM sideband receiver;
- an exterior FM antenna (recommended); and
- an audio cassette player and tapes to record programs.

Broadcast radio, like broadcast television, sends information over the airwaves in one direction to a largely undifferentiated audience. The Wisconsin Public Radio Network (see figure 12) airs approximately 18 hours of news, information, and entertainment programs daily.

Programs from the School Radio Service are also available in Wisconsin. The Wisconsin Educational Communications Board (WECB) operates an instructional school radio service on subcarrier frequencies of the state's public FM radio stations. A specially equipped receiver, which is available by subscription, and an FM radio antenna are needed to receive this sideband.

Schools that subscribe to the School Radio Service can receive more than 20 audio series with a wide range of K-12 instruction and inservice programs for teachers and administrators. Programs are transmitted during school days from 8:30 a.m. to 11:30 a.m. Information about school radio series can be found in "Parade of Programs." The listing, available in both print and electronic versions, includes a series description, program titles, broadcast schedule, and the subject area and grade level to which each show is geared. Most series have companion teacher materials to help teachers integrate them into the existing curriculum.

Modes of Instruction

The primary mode of instruction in radio is one-way audio. For the most part there is no interaction between the instructor and the learners. Some programs are live and include calls from students, but these are mostly aired on public radio and not the School Radio Service. Written questions can be submitted to the radio program managers for discussion on a later broadcast.

Broadcast Television

Equipment needed at the school so broadcast television, both commercial and public, can provide instruction includes

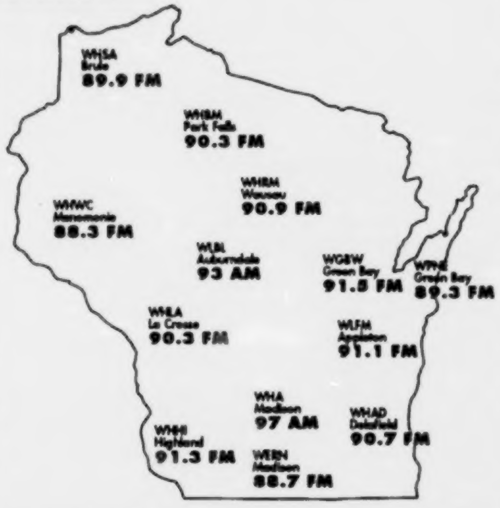
- an external antenna;
- wiring to bring the TV signal to the classroom (can be a single wire to a single classroom or an internal cable throughout the school);
- a television set or monitor; and
- a videocassette recorder (VCR) and videotapes to record programs.

Broadcast television is a technology that reaches many receivers from one transmission site. It has been an efficient and relatively cost-effective way to deliver programming to the public since the 1950s.

In a study of how schools used television and video during the 1990-91 school year, the Corporation for Public Broadcasting (1991) found instructional television and video are available to

Figure 12

Wisconsin Public Radio Stations



Source: Wisconsin Educational Communications Board, 1990.

BEST COPY AVAILABLE

almost every teacher in the nation. Approximately 75 percent of teachers incorporated these technologies into their curriculum, primarily as a springboard for class discussions, presentations, and writing assignments. Teachers reported viewing a variety of television and video programs, citing over 1,700 titles. The major program sources came from broadcast networks, with CNN listed as the most available source of cable television.

Commercial Television

Commercially broadcast television includes a limited amount of programming that can be of educational value in the classroom. Specials created by the National Geographic Society and other network producers, as well as shows from network news departments, can sometimes be of value in education.

One example of commercially produced instructional programming is found on the CBS network. For more than a decade, CBS has been airing award-winning, original contemporary dramas involving conflicts and dilemmas faced by today's youth. The programs are part of its "Schoolbreak Specials" series and usually run once a month throughout the school year.

The one-hour dramas are developed with educators, psychologists, religious leaders, and experts in related fields. They are intended to give teachers and students in grades 7 through 12 the opportunity to explore serious topics. Broadcasts are close-captioned for the hearing impaired.

School personnel can videotape the programs and show them twice in a school or library during a ten-day period. Taped programs may be retained for preview for 45 days, after which the recordings must be erased. Their use is governed by the federal government's Fair Use regulations concerning copyrighted material.

Program guides are available to help teachers employ the "Schoolbreak Specials" as catalysts for discussion, research, and other classroom activities. Guides include a program synopsis, discussion topics, suggested activities, and additional resources for each program. They may be ordered from KIDSNET, a nonprofit group based in Washington, DC, that reviews commercial television programs for appropriateness for the classroom or for viewing by school-aged children. KIDSNET also publishes guidelines on how to use commercial television effectively in the home.

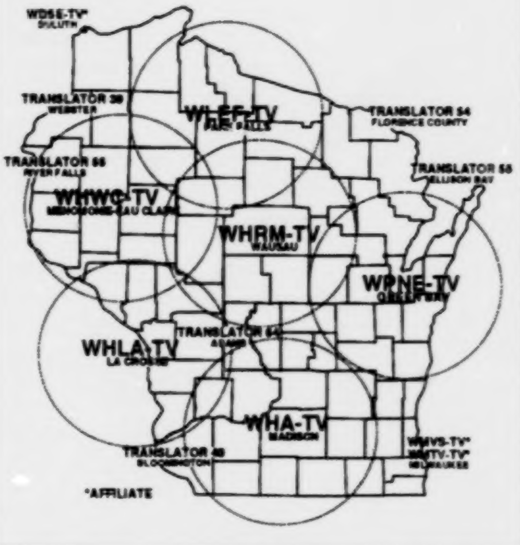
Wisconsin Public Television

The Wisconsin Public Television Network began in 1954 as one station associated with WHA Radio at UW-Madison. (See figure 13) Today the network airs more than 100 K-12 series, consisting of approximately 1,500 individual programs. They are telecast between 8:30 a.m. and 3:30 p.m. during the school day on television stations covering virtually the entire state. "Parade of Programs," a schedule book produced annually by the state WECB, has a complete listing of these programs. It contains a description of each instructional television (ITV) series, titles of individual programs, broadcast schedules, and the subject area and grade levels for each series. There are also companion teacher guides to assist classroom teachers in integrating instructional shows into their existing curriculum.

A free, online computer service called Learning Link Wisconsin also helps classroom teachers use ITV programming. One of Learning Link's major features is Curriculum Connection, a computer database with information about ITV programs broadcast on Wisconsin Public Television and listed in "Parade of Pro-

Figure 13

Wisconsin Public Television Stations



Source: Wisconsin Educational Communications Board, 1989.

grams." Curriculum Connection can be accessed to obtain a description of the ITV programs and to cross-reference each show to a particular topic or grade level. Learning Link also offers an electronic mail service, provides a "forums" section that serves as an electronic bulletin board, and includes file libraries and discussion centers.

In addition to these K-12 programs on public television, approximately 16 courses are offered by the UW System and WTCS. These courses cover topics such as education, childcare, Vietnam, General Educational Development (GED) preparation, and business and may be taken for credit, recertification, or continuing education units. Registration is by mail and instructor/learner interaction is via telephone during predetermined "office hours." Course work and exams are graded by mail. UW telecourses are available statewide, while WTCS classes are offered by participating technical colleges.

Low-Power Television

Low-power television is broadcast with the same technology as commercial television, except such stations are licensed for a much smaller area because of their weaker signals. The coverage area may be five to 30 miles, or about half the size of other commercial television stations.

These stations can be owned and operated by a college campus, a school district, or any other entity that can win approval from the Federal Communications Commission (FCC). These stations are different from the community access or education channels on a local cable television system because they are separately licensed. They also tend to be broadcast over the air instead of being delivered via cable. Some low-power stations may be seen on local cable television systems, but this is not their usual mode of transmission.

Modes of Instruction

The primary mode of instruction over broadcast television is one-way audio and video. For the most part there is no interaction between the instructor and the learner. This is particularly true of shows in the "Parade of Programs" on public television. However, special programs broadcast live on the state public television network, such as "Teen Connection" and "Teen Talk," have toll-free telephone numbers so participants can communicate with others taking part in the show.

Advantages of commercial television as a tool of instructional telecommunications are as follows:

- This medium is available in almost every home and school in Wisconsin.
- VCRs allow shows to be recorded so they can be viewed at a later time.

Disadvantages of commercial television for instruction are as follows:

- There is no interaction between the program and the students.
- Without a VCR, these programs must be viewed when they are broadcast.
- A lack of programming exists that is suitable to be incorporated into a curriculum.
- Students must also view commercials, unless they are deleted during taping.

Wisconsin Public Television programming is tailored for education and is a far greater source of programming than commercial television. Advantages of Wisconsin Public Television for instruction over commercially broadcast television are as follows:

- This network reaches practically every home and school building in the state.
- This network provides a large number of K-12 enrichment programs professionally produced for the classroom.
- Most programs have guides to assist teachers in integrating the material into the existing curriculum.
- Several of the programs broadcast have computer programs, CD-ROMs, and laserdiscs to supplement the video programs.
- These programs can be videotaped for later use.

Disadvantages of using Wisconsin Public Television for instruction are as follows:

- There is no interaction between the program and the students.
- Without a VCR, these programs must be viewed when they are broadcast.

Microwave Television

Microwave communications, a technology available since the late 1960s, uses very high radio frequencies to transmit television, telephone, and data services. Terrestrial microwave systems consist of a series of relay stations located in a line-of-sight path to each other. They can simultaneously transmit a number of television programs or thousands of telephone or data circuits.

Satellite microwave systems have supplemented these terrestrial facilities by linking various terrestrial systems into a worldwide communications network. Microwave television transmission can be omnidirectional, as in ITFS, or point-to-point. Both kinds of transmission are used in Wisconsin for distance learning.

ITFS

Equipment needed at the school to participate in an ITFS system includes

- an ITFS antenna;
- towers for line-of-sight path to the transmitter site (if necessary);
- a downconverter to convert the microwave signal to signals a television set can receive;
- cabling to bring the signal to the classroom (a single wire to a single classroom or an internal cable throughout the school);
- signal boosters, depending on the length of cable needed to feed the signal to each classroom;
- a television set or monitor for each classroom that can receive the entire range of VHF and UHF channels (sometimes referred to as "cable ready");
- a VCR and videotapes to record programs;
- a speaker phone or telephone convener box; and
- a dedicated telephone line (recommended).

ITFS is a group of 28 television channels established for educational institutions in 1963 by the FCC. ITFS is referred to as a "narrowcast" technology because it reaches a small, targeted audience. A "broadcast" technology is one that is designed to reach a mass audience, such as commercial television. A special antenna and signal converter are required to receive an ITFS signal. Because ITFS transmitters are usually limited to ten watts of power, a usable signal covers a radius of only 20 to 30 miles. The farther away a receiving site is from the transmitter, the larger and more costly the antenna it needs to receive the signal.

ITFS is a line-of-sight technology, so a signal will be obstructed by hills, buildings, trees, or other objects that get in its way. (Figure 14 shows a clear line of sight is necessary for ITFS transmission.) Consequently, the antenna at the receive site must be mounted so that a direct, unobstructed path exists to the transmission tower. If a school district is surrounded by trees, hills, or large buildings, it may have to construct a tower to secure a clear line-of-sight path for its antenna.

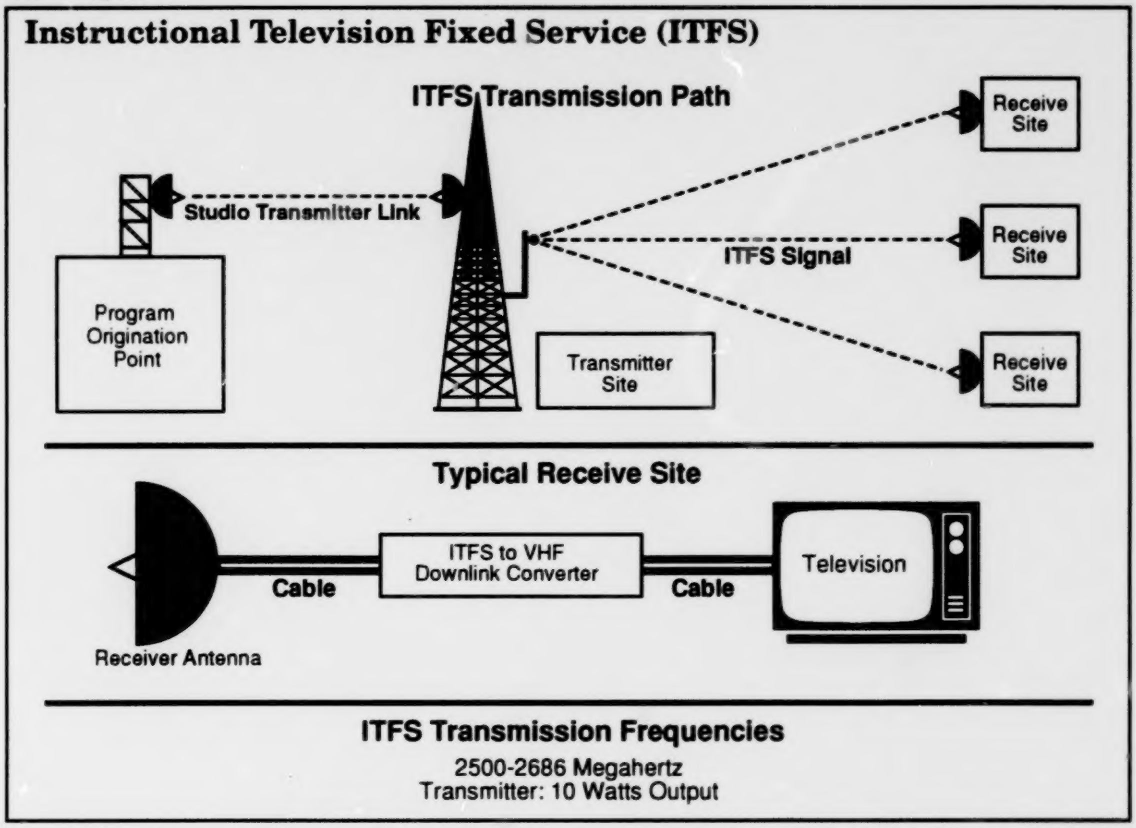
The 28 microwave channels are in the 2,500 to 2,690 megahertz band of the radio spectrum and are grouped into seven sets of four channels each. An ITFS license will include four channels, but no more than that. This multichannel capacity makes it possible to simultaneously feed several channels from different locations, thereby creating an interactive system with multiple audio and video inputs. ITFS can be engineered as a two-way system for both video and audio, but is intended primarily as a one-way video and two-way audio technology. It is also possible to design systems with multiple simultaneous audio and video sources, but this type of ITFS network is more costly and cumbersome. (Wisconsin Educational Communications Board, 1990)

ITFS systems can telecast live, locally originated programs to many sites, such as conferences and teacher inservice programs. These systems also enable a teacher to instruct students in multiple, remote classrooms. Twenty ITFS systems in Wisconsin are licensed to the WECB and another nine are licensed to WTCS districts. (See figures 15 and 16 for maps of where these networks are located.) These systems place ITFS in reach of approximately 60 percent of all K-12 districts in the state. Not all districts can take advantage of these services, however, because of topography and this technology's line-of-sight requirement.

Programs typically originate in a studio at a local educational institution. Since ITFS serves all educational units within its signal area, participants can also receive courses from local UW and WTCS campuses. Courses on "Teaching over Television" and "Critical Thinking" have been offered to secondary school staff by two UW campuses, and a third delivers engineering courses to employees at nine metropolitan industrial work sites. Several WTCS campuses use ITFS to provide courses in business, communications, and technical skills as well as parenting and equivalency diploma classes.

In addition, some ITFS systems have banded together to offer courses that individual systems had not been able to provide on their own, such as Japanese, Russian, French, AP calculus, and AP English. And because this technology can cover several school districts, joint meetings of

Figure 14


Instructional Television Fixed Service (ITFS)

ITFS Transmission Path
Studio Transmitter Link
Program Origination Point
Transmitter Site
ITFS Signal
Receive Site
Receive Site
Receive Site
Typical Receive Site
Receiver Antenna
Cable
ITFS to VHF Downlink Converter
Cable
Television
ITFS Transmission Frequencies
2500-2686 Megahertz
Transmitter: 10 Watts Output

Source: Wisconsin Educational Communications Board. *Instructional Television Fixed Service: A Statewide System*. Madison: Wisconsin Educational Communications Board, 1990, exhibit B.

athletic conferences and regional school board associations can be held, thus cutting down the amount of travel between districts.

ITFS can also be combined with a satellite dish to retransmit programming received from a satellite. It can also retransmit a wide range of teleconferences for student enrichment, staff development, or inservice needs. Several ITFS systems also provide Satellite Educational Resources Consortium (SERC) programming. A local user group develops the ITFS programming schedule based on the needs of participants within the signal area.

Modes of Instruction

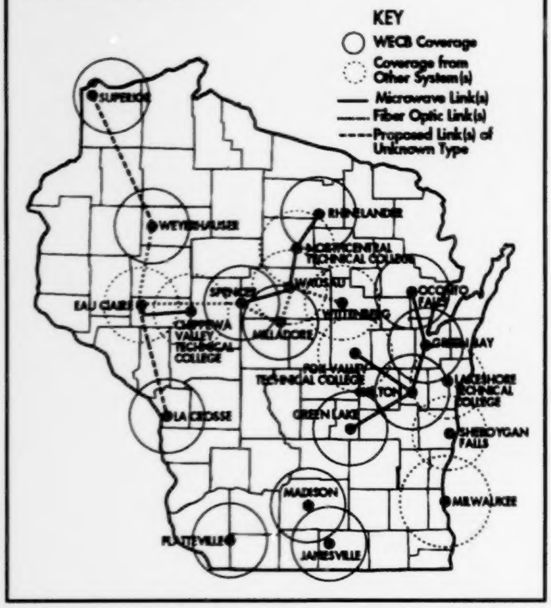
The primary mode of instruction over ITFS comprises one-way video and two-way audio. Local programs originate in a studio and national programs are brought into the system by satellite dish. These satellite-based programs are then retransmitted over ITFS.

A telephone-based return system capable of carrying voice and data links learners with the instructors, whether they are in a local ITFS studio or a national satellite studio. Fax machines and computers enable instructors and learners to exchange assignments, quizzes, exams, and student records.

ITFS can also deliver two-way audio and video instruction. The Central Wisconsin Educational Television Network (CWETN) project connects several small rural districts in west-central Wisconsin with two-way ITFS technology. Each school in this two-way ITFS system needs a studio, because each site will be able to originate as well as receive instruction. Two-way data communications can occur in all ITFS systems over telephone lines. Computers and fax machines make it possible to exchange

Figure 15

WECB Statewide ITFS Network


KEY
WECB Coverage
Coverage from Other System(s)
Microwave Link(s)
Fiber Optic Link(s)
Proposed Link(s) of Unknown Type
SUPERIOR
WEYERHAUSER
RHINELANDER
NORTHCENTRAL TECHNICAL COLLEGE
WAUSAU
SPENCER
OCONTO FALLS
EAU CLAIRE
WITTENBERG
CHIPPEWA VALLEY TECHNICAL COLLEGE
MILLADORE
GREEN BAY
FOX VALLEY TECHNICAL COLLEGE
CHILTON
LAKESHORE TECHNICAL COLLEGE
LA CROSSE
GREEN LAKE
SHEBOYGAN FALLS
MADISON
MILWAUKEE
PLATTEVILLE
JANESVILLE

Source: Evans Associates. *Wisconsin Distance Education Technology Study*. Madison: Wisconsin Educational Communications Board, 1993, p. B-1.

assignments, quizzes, exams, and student records throughout the system.

Advantages of using one-way ITFS technology for instruction include the following:

- Students can see and hear the teacher and teachers can hear the students through a telephone bridge.
- It is relatively inexpensive to receive an ITFS signal, although it is more costly to construct and equip an ITFS studio.
- ITFS signals are reserved for education, so they are relatively secure frequencies.
- ITFS signals have a range of approximately 30 miles, so they can serve as a regional technology to meet the needs of schools within the signal area.
- Because ITFS systems are regional technologies, they are governed and scheduled by their users.
- ITFS signals can be relayed from one signal area to another if they are within a 30-mile range.
- Signals from other technologies such as satellite, broadcast and cable television, and fiber optics can be retransmitted over ITFS; this reduces the amount of investment in certain technologies in the signal area and provides a cost-effective last mile delivery system.

Disadvantages of using one-way ITFS for instruction include the following:

- The teacher cannot see the students and students cannot see participants in other classes.
- The technology is line-of-sight and does not work in all terrains, so costly towers may be required so some locations can receive the signal.
- The technology is subject to some weather and some microwave interference.
- Teachers must travel to the studio to conduct their classes.
- Bell schedules, school calendars, and course begin and end dates will not necessarily correspond with local schedules and calendars. (Barker, 1992)

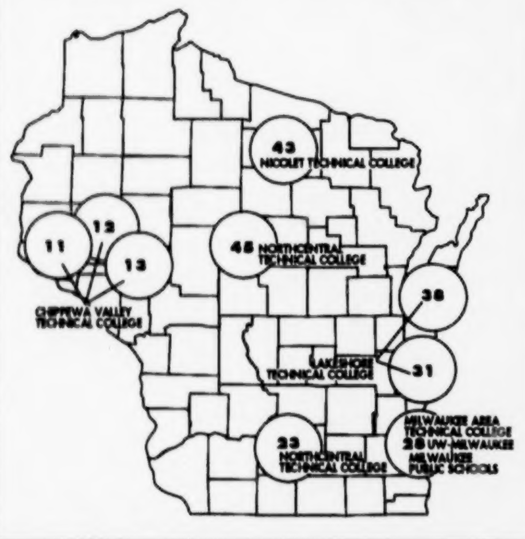
For the advantages and disadvantages of a two-way version of ITFS, see the section applying to two-way interactive fiber optics technology on pages 51-52.

Point-to-Point Microwave

Equipment needed for point-to-point microwave instruction includes

Figure 16

WTCS Statewide ITFS System


43
NICOLET TECHNICAL COLLEGE
11
12
13
CHIPPEWA VALLEY TECHNICAL COLLEGE
45
NORTHCENTRAL TECHNICAL COLLEGE
38
LAKESHORE TECHNICAL COLLEGE
31
33
NORTHCENTRAL TECHNICAL COLLEGE
MILWAUKEE AREA TECHNICAL COLLEGE
28 UW-MILWAUKEE
MILWAUKEE PUBLIC SCHOOLS

Source: Wisconsin Educational Communications Board. *Instructional Television Fixed Service: A Statewide System*. Madison: Wisconsin Educational Communications Board, 1990, exhibit D.

- a microwave antenna,
- receivers/transmitters (and towers to support them, if necessary),
- television cameras,
- microphones,
- a television set or monitor for each classroom that can receive the entire range of VHF and UHF channels (sometimes referred to as "cable ready"), and
- a VCR and videotapes to record programs.

Point-to-point microwave uses FM radio waves to send audio signals and AM radio waves to send video signals from one point to another. These systems, licensed by the FCC at 6 megahertz, have a range of up to 30 miles depending on antenna size, transmitter power, and receiver sensitivity. A 23 gigahertz frequency transmits signals for short hauls of up to 15 miles. The signals are directional and may be either simplex (one-way audio and video) or duplex (two-way audio and video). This technology can provide one or two audio subcarriers that can carry numerous data, audio, and video channels on a single system. Four channels of full-motion video can be transmitted over one microwave system.

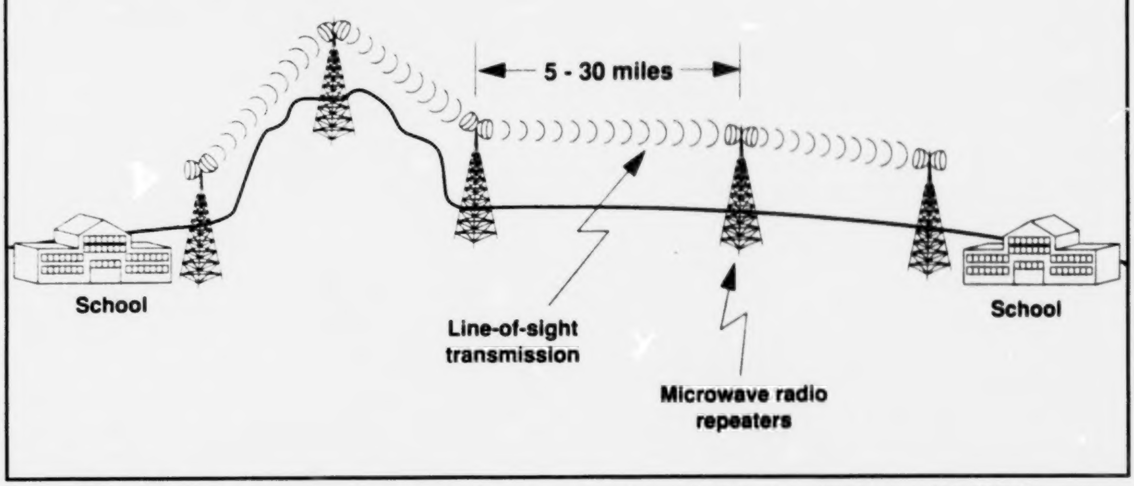
Towers need to be constructed to support the microwave transmitters and receivers. Tower height depends on the terrain because they need to be aligned by line of sight with no obstacles between the transmitter and receiver. Figure 17 shows the line-of-sight requirement for point-to-point microwave transmission. Outages due to weather are minimal and adding channels is relatively inexpensive compared to fiber optics and cable systems. The point-to-point feature provides a secure system with access to one or more receivers.

Point-to-point microwave can be used in the same manner as ITFS to transmit live interactive communications, to rebroadcast satellite programs, or to air taped programs. In addition, a microwave network can be designed with additional audio and data channels for a telephone network to carry fax transmissions, data lines to connect to computer systems, and additional audio lines for teleconferencing.

Northcentral Technical College (NTC) in Wausau has constructed a microwave system that has a duplex channel to, and a simplex channel from, each of its five regional campuses. This system enables NTC to deliver up to seven courses or programs simultaneously. It also connects regional campuses to the main campus computer system. It has expanded its audio channels by adding seven additional telephone lines to each of its regional campuses, with one of the audio lines dedicated to fax communications. The simplex channel from each of the regions serves as a return video and audio link

Figure 17

Microwave Communication System



Source: Office of Technology Assessment. *Linking for Learning: A New Course for Education*. Washington, DC: U.S. Government Printing Office, 1989, p. 72.

for one of the WECB's ITFS channels, which are also a part of NTC's telecommunications system. The additional audio lines also provide toll-free audio return lines for the other ITFS channels.

Modes of Instruction

Point-to-point microwave can provide one-way video and two-way audio or full two-way audio and video transmissions. This type of technology can simultaneously transmit audio and video signals along with print materials.

For the advantages and disadvantages of one-way point-to-point microwave technologies for instruction, refer to the previous section in this chapter on ITFS technology (page 42). For the advantages and disadvantages of two-way interactive point-to-point microwave technology for instruction, see the section on fiber optics (pages 51-52).

Cable Television

Equipment needed at the school to receive instruction via cable television includes

- cable service from the local distributor;
- cabling to bring the signal to the classroom (a single wire to a single classroom or an internal cable throughout the school);
- a "cable ready" television, or a monitor, in each classroom;
- a VCR and videotapes to record programs;
- a speaker phone or convener box;
- a dedicated telephone line (recommended);
- special response equipment if required by a particular program;
- special modem and computer for XPRESS XChange.

Cable television began as a way to provide television to communities unable to receive a broadcast signal. The increased dependence on communication satellites to deliver programs and the decrease in the cost of this technology now allow cable companies to deliver a wide range of specialized programming to subscribers. Cable television today includes channels dedicated to sports, movies, news, and even education.

Cable television is transmitted over a coaxial cable that can carry broadcast television signals. Figure 18 illustrates how cable companies service their customers. Satellites provide a direct feed of the television signals to cable companies, which then deliver them to customers via cable. The newer fiber optics technology, discussed later in this chapter, can be used in place of coaxial cable. Equipment required for cable television includes modulators, demodulators, addressable converters, and amplifiers. The coverage pattern of coaxial cable can be point-to-point or point-to-multipoint, with an average range of up to 30 miles.

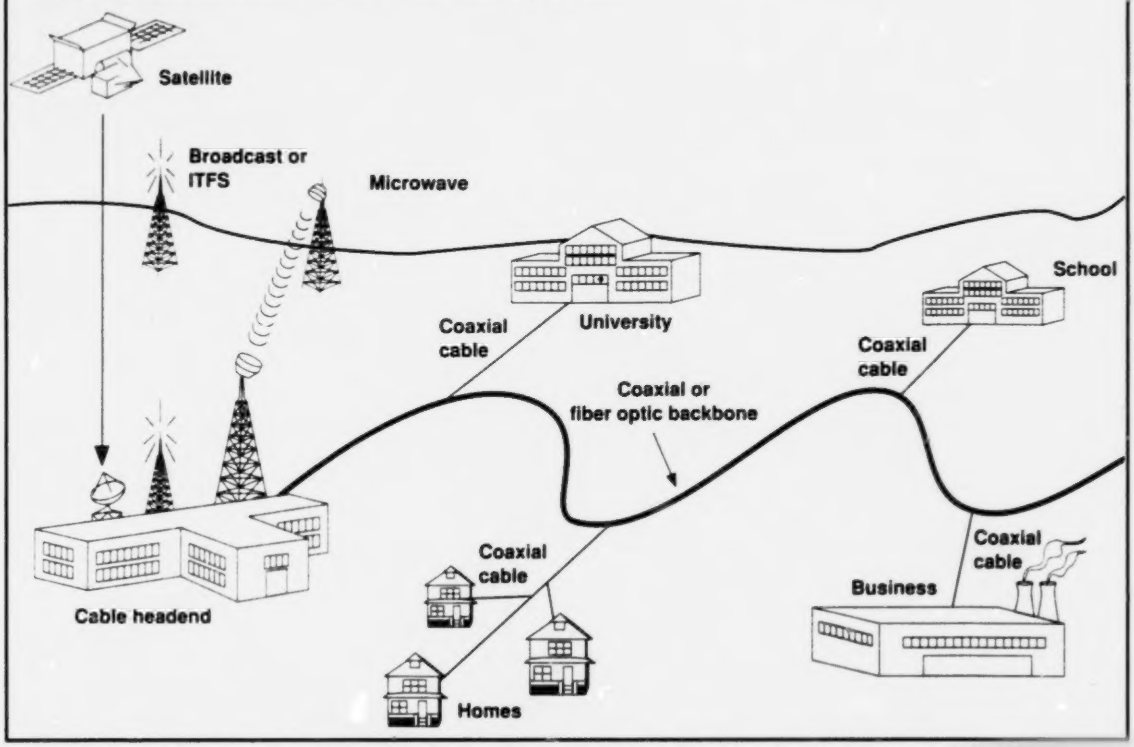
Although coaxial cable is fully interactive, it is limited by the number of channels it can carry, and data transmission requires a separate channel. The number of channels available for education can be determined between a cable company and school district when local government awards the cable franchise. Once the community's cable operation is in place, there is less chance for expansion of the system's capabilities.

Coaxial cable is not significantly affected by adverse weather conditions, although one common problem is the disruption of service by accidental excavation of an underground cable. Through business and school partnerships, this technology can provide significant cost savings to both parties for multichannel capabilities. It also has the advantage of being locally franchised and regulated. Negotiations between school districts and cable companies can be very complex and time-consuming. There may be no need for expenditures for costly towers and satellite dishes, but cable is primarily confined to areas served by a cable company. Therefore, it will be unavailable in communities without cable television service. Negotiations between multiple school districts and multiple cable companies can be difficult and lengthy. (Kitchen, 1989)

Early cable television systems were one-way, which meant they could send programming to subscribers. Now, interactive cable gives customers greater freedom of choice in programs and added features and services. In the near future these new services will include home security for burglary and other threats, home shopping, at-home banking, video games that interact with a central computer or other cable subscribers, conferencing, videotext delivery, and interactive instruction. For example, Japanese television for several years has incorporated cable television and videodiscs for educational applications. (Wedemeyer, 1986)

Figure 18

Cable Television Distribution System



Source: Office of Technology Assessment. *Linking for Learning: A New Course for Education*. Washington, DC: U.S. Government Printing Office, 1989, p. 69.

Dedicated Channels

Schools and districts can offer distance learning through cable channels set aside, or dedicated, exclusively for local or community programming. These "dedicated" channels can transmit locally produced courses and instruction from one building or school district to many others. The channels can be assigned specifically for schools or can be one of the government, educational, or community-access channels some communities negotiate when they award local cable franchises. These dedicated channels may be part of the community cable loop that goes into the home of each subscriber.

Cable television systems also provide a closed government loop, called a "B" loop, that is only accessible to local and county government offices, school buildings, or other agreed-upon locations. This "B" loop can also carry distance learning programs.

Japanese is currently being taught in three high schools in the Milwaukee area over a live, two-way cable connection. The system uses one channel to send the signal to the receiving classrooms and one channel to receive the signal from each of the two remote classrooms. Consequently, three channels are needed for a full two-way video/audio system.

Cable Program Providers

Schools and districts can also receive distance learning by purchasing programming from members of Cable in the Classroom (CIC), a nonprofit service of the Cable Alliance for Education. Sometimes CIC allows the programs to be recorded without a fee. CIC consists of more than 30 cable distributors serving more than two thirds of the nation's cable television audience.

Some CIC members help education by offering cable installation to all public schools or providing equipment such as VCRs, monitors, teaching materials, and computers to participating schools. Sometimes these providers even sell satellite dishes at cost to public schools outside their cable delivery areas.

Cable systems throughout Wisconsin and the nation receive programming via satellite and then transmit it over coaxial cable to subscribers. Thus, a school district without cable service can receive this programming with a C-band or Ku-band steerable satellite dish. The dish, however, must be equipped with descramblers needed for the various commercial channels. (An explanation of dishes is given in the section on satellite technology later in this chapter.)

When using a satellite dish to receive cable programming, schools must be sure to know if descramblers are needed and how much they cost. Some commercial channels will provide a school with a free descrambler if the school is using its programming for instructional purposes; this offer varies with the channels. Most educational channels are not scrambled and tend to be located in the Ku-band portion of the satellite frequency spectrum.

Cable television providers offer a variety of programming including news, documentaries, and presentations of drama and the other performing arts. There are also curriculum-based programs for math, English, science, social studies, biology, foreign languages, health, and vocational and technical studies. They are offered free of commercials and copyright clearances range from Fair Use (single use within ten days and 45 days' retention for evaluation) to perpetuity. Many programs include curriculum-based support materials. Appendix C describes major cable providers and programs designed for use in K-12 classrooms.

Major program providers offer guides to help classroom teachers use their programs and to identify additional readings and resources. Several additional guides on satellite and cable television educational programming are also available including *Cable in the Classroom* magazine, which can be ordered from local cable television operators. This magazine provides information on selected cable, broadcast, and public television programming arranged by subject matter. *Cable in the Classroom* also includes study guides for programs of interest, how-to features that demystify teaching technology, curriculum-building articles about programming, and directories of free teaching materials. A second guide titled *The Educator's Guide to Cable Television* has tips on how to use programs in the classroom, reviews them by subject matter, and includes weekly broadcast schedules.

Modes of Instruction

Several modes of instruction are possible with cable television, depending on whether a district is programming its own dedicated channels or obtaining it from cable providers. Two-way audio and video instruction can take place over a district's dedicated channels. This mode requires one channel for the originating classroom and one for each receiving classroom. If only one dedicated channel is available for education, one-way video and two-way audio instruction can occur with a telephone-based return system. In some cases, a government or public-access channel can be borrowed to increase the number of channels available for two-way audio and video. Local governmental bodies that deal with cable television will indicate if this is feasible.

One-way video, two-way audio instruction is also possible when live, interactive courses are taken over cable television. TI-IN, a satellite-based provider of student courses and staff development programs from Texas, also offers programming on cable television. Since this delivery mode is basically one-way audio and video, a telephone-based audio return system is needed for an interaction circuit. This return system is coupled with a computer that has a modem to send and receive assignments, quizzes, exams, and student records.

One-way audio and video instruction is the prevalent mode for enrichment programs produced by cable program providers that air on commercial channels like Arts and Entertainment, Discovery, and Nickelodeon. On the XPRESS XChange channel, a special computer modem enables a school to separate one-way data communications from the cable television's video and audio signals. This information can then be printed out.

The advantages and disadvantages of one-way dedicated cable television channels for instruction are the same as those for one-way ITFS and satellite technologies (see pages 42 and 49).

The advantages and disadvantages of two-way interactive dedicated cable television channels for instruction are the same as those discussed for fiber optics (see pages 51-52).

The advantages and disadvantages of programming distributed by members of Cable in the Classroom are the same as those for Wisconsin Public Television programs (see page 39).

Videotext and Teletext

Equipment needed at the school so classes can receive videotext and teletext includes

- a television equipped with closed caption capability; and
- equipment to send signals over the television's vertical blanking interval (VBI). VBI is the part of the television video signal in the black bar that can be seen at the top of the television picture.

Videotext is a generic term referring to electronic messages of text and graphics. Essentially there are two types of videotext, one-way and two-way. One-way is known as teletext, or broadcast videotext. Teletext is usually delivered via the VBI on a standard broadcast or cable television channel. Teletext services usually concentrate on rapid delivery of data that is constantly changing, such as stock market quotations, farm commodity reports, and weather information.

Two-way videotext is referred to as videotext (the most common designation), view data, or interactive videotext. This type of service functions very much like an online database. However, the addition of color graphics is an identifying characteristic of videotext. These two-way services are delivered via cable television or, more commonly, by telephone. Interactive videotext offers unlimited databases as well as many two-way services such as banking, computer-aided instruction, online shopping, and electronic mail. (Wedemeyer, 1986)

Modes of Instruction

This technology will not be used widely. However, it can fill specialty niches such as relaying daily stock market quotations to a business class, farm commodity reports to an agriculture class, and weather updates and information.

Satellite

Equipment needed at the school to receive distance learning via satellite includes

- a satellite dish (C-band or Ku-band steerable recommended);
- cabling to bring the signal into the school;
- a receiver to steer the dish and capture the signal;
- cabling to bring the signal to the classroom (a single wire to a single classroom or an internal cable throughout the school);
- a television or monitor for each classroom that can receive the entire range of VHF and UHF channels (sometimes referred to as "cable ready");
- a VCR and videotapes to record programs;
- a fax machine (optional);
- a speaker phone or convener box;
- a dedicated telephone line (recommended); and
- special response equipment (for example, when needed with SERC or TI-IN programming).

Communication satellites are essentially nothing more than radio-relay stations in space, fulfilling much the same purpose as microwave towers. Satellites receive radio signals transmitted by an "uplink" from the ground, amplify them, translate them in frequency, and retransmit them back to the earth. Satellites are 26,000 miles out in space in a geosynchronous orbit of the earth. Geosynchronous means the satellites always remain in the same position relative to the surface of the planet. Satellites in this type of orbit can transmit a signal over about half the earth. The coverage area of a satellite's signal is known as a footprint. The size of the satellite's transmission range makes satellite transmissions insensitive to distance, because they can simultaneously reach every downlink on one half of the earth. (Campanella, 1989)

In 1957, the former Soviet Union launched the first satellite into space. Communication satellites since then have become a major part of the national and international communications network. Communication satellites now connect even the most remote spots of the world and can transmit voice, data, and video almost anywhere. Currently there are 38 communication satellites in orbit over North America, each with the capacity to carry or transmit between 24 and 48 channels. The pioneer in the field of satellite interconnection was the Public Broadcasting System, which in 1978 connected its public television stations. (Wisconsin Educational Communications Board, 1988)

Newer satellites with more powerful signals have eliminated the need for high-cost, high-maintenance receiving dishes, making satellite transmissions available to almost any school with basic technical support on the premises. Satellites formerly were only able to send signals indiscriminately to large geographical areas. But new technologies allow direct satellite broadcasts to specific regions of a nation or state. And advancements in compression technology will one day multiply the world's communications capabilities five-fold to an estimated 180,000 channels. These increases will be necessary to meet the expected growth during the rest of the century in satellite traffic, which consists of telephone and television signals, teleconferencing, electronic mail, data transmission, and other forms of communication. The volume of this traffic is estimated to be increasing at 20 percent annually. (Wedemeyer, 1986)

Most commercial satellite systems have two primary frequency bands, C-band and Ku-band. An "uplink" consists of an antenna, amplifiers, and equipment necessary to transmit a signal to a satellite. A "downlink" is the equipment needed to receive a satellite signal on the ground. A "transponder" is the equipment on board a satellite that receives signals from earth, amplifies them, changes their frequencies, and sends them back to earth. One full transponder can transmit one television channel. A satellite in the past usually had 12 transponders, but newer satellites have twice as many. Each transponder on a satellite can be reused by means of polarization, thereby providing 24 wideband communications channels from a satellite that has 12 transponders. Polarization can either be vertical or horizontal.

Satellite transmission is costly, so it is reserved for certain types of services such as television, data transmission, and long-distance telephone calls. A typical satellite has the capacity to simultaneously transmit up to two color television channels, 1,200 voice channels, 16 data channels at the rate of 1.544 megabits per second, 400 data channels at 64,000 bits per second, and 600 data channels at 40,000 bits per second. By way of comparison, the first INTELSAT satellite launched in 1971 could transmit only 4,000 voice circuits and two color television channels. The INTELSAT V satellite launched in 1981 has a capacity of 12,000 two-way voice circuits plus two color television channels. (Dordick, 1989) And as discussed in chapter 2, one current INTELSAT VI satellite can transmit 20 billion bits of information in seven to 20 seconds.

Video compression technology enables some transponders to transmit two or more television channels. Currently, SERC and TI-IN transmit at half-transponder strength. This means they can split one full transponder into two channels, thus doubling the amount of programming over the same transponder. However, schools need special receivers for their satellite dishes so they can use programming relayed on half-transponders. In the near future, digital compression technology will enable each transponder to carry ten or more video channels. Transponders can carry only one channel today.

Each satellite band has its benefits and its drawbacks. The C-band frequencies are relatively low power and, therefore, relatively inexpensive to operate. They require larger dishes to receive the signal, however, and are subject to some terrestrial microwave interference. Ku-band satellites need more power and are more costly to operate, but have smaller, less expensive receive dishes. Also, their signal is not subject to interference from the more common microwave transmissions. Most educational programming available by satellite is on Ku-band. However, Ku-band signals tend to degenerate in heavy rain because the signal is about the size of a raindrop. (Wisconsin Educational Communications Board, 1993)

A substantial amount of instructional programming is available via satellite. Smith Holt, founder of Oklahoma State University's Arts and Sciences Teleconferencing Service (ASTS), has noted that the EDSAT Institute has identified at least 111 providers of satellite-delivered educational programming. The majority of these are not involved in live, interactive television, but those that do offer a variety of programming. (Holt, 1991) Appendix C looks at major K-12 satellite providers.

If full-curriculum courses are not needed, enrichment programs are available. They include shows on space and space flight from the National Aeronautics and Space Administration (NASA), science seminars on supercomputers and acid rain, and live and interactive "electronic field trips" to research and development centers and schools around the world. Satellites also give students access to radio and television channels that broadcast in Japanese, Spanish, and French. Some of these channels are from foreign countries while others originate in the United States.

Professional staff development and continuing education programs are offered by each of the student course providers mentioned above as well as by National Technological University (NTU), which gives graduate-level courses in computers, engineering, and management. The National University Teleconferencing Network (NUTN) delivers teleconferences and informational programming to a variety of educational and business audiences. UW System schools are active members of NUTN and the UW-Madison College of Engineering produces programs for NTU. DPI, WECB, and the UW-Extension collaborate with SERC to present inservice and graduate courses for K-12 teachers.

Modes of Instruction

The primary mode of instruction with satellite technology incorporates one-way video, two-way audio, and two-way data. An audio-based return system capable of carrying voice and data links learners with the instructors. Fax machines and computers help instructors and learners to exchange assignments, quizzes, exams, and records.

Advantages of satellite instruction include the following:

- Students can see the teacher.
- Teacher-student audio interaction is possible.
- Real-time distribution of instructional materials, including handouts, tests, and assignments, is possible at remote sites through printers.
- Because satellite signals can cover large geographical areas, this technology is relatively cost-effective;
- Most satellite systems are "turn-key" operations, providing program offerings, scheduling, instruction, student grading, and distribution of materials to participating schools.
- Satellite programming is the most widely known distance learning technology, making it easier for local school boards and decision makers to support.

Disadvantages of using satellite television as a means of distance learning include the following:

- Program offerings are centralized, thereby limiting control by local school districts.
- The television teacher cannot see the students.
- Students at the receiving sites cannot see students at other sites.
- Telephone contact during class is not immediate, preventing some students from calling in.
- An audio echo is common when students use the telephone to talk with the television teacher.
- Some receiver dishes, especially Ku-band dishes, are weather sensitive and can lose their signals, especially during heavy rain, snow, or dust storms; and both the C-band and Ku-band are susceptible to periodic "sun outages."
- The potential exists for large class sizes of 200 to 300 students at a time, limiting the opportunity for teacher-student interaction.
- Student-to-student interaction between different sites is extremely limited at best, and nonexistent at worst.
- In addition to start-up costs for a satellite dish and other appropriate receiving equipment, the school must pay an annual subscription fee to the satellite vendor to receive programming.
- Differences in bell schedules, time zones, and dates for spring breaks, holidays, and so forth often create conflicts with local school schedules, and are not easy to resolve. (Barker, 1992, p. 36-37)

Fiber Optics

To use fiber optics for instruction, schools will need a variety of equipment, including

- fiber optics cabling to each point on the network;
- multiple electronic switching devices throughout the network;
- codecs (coders/decoders) to put signals onto the fiber and to take them off at the other end;
- receivers/transmitters to send and receive audio and video signals to and from the codecs;
- television cameras;
- microphones;
- a television set or monitor for each classroom that can receive the entire range of VHF and UHF channels (sometimes referred to as "cable ready");
- a VCR and videotapes to record programs; and
- additional equipment as needed.

Fiber optics, one of the newest, most powerful, and potentially most expensive of the two-way interactive technologies, employs a glass cable that transmits light signals instead of electrical signals. Light conducted by fiber optics systems is from the ultraviolet, visible, and infrared regions of the electromagnetic spectrum. The fiber is able to transmit the beam of light because the wrapping of the fiber functions as a mirror and reflects the light beam back into the core, where it remains until it again strikes the core wrapping. This reflecting action occurs continuously as the beam travels from one end of the fiber to the other.

A fiber-based communications system consists of a laser transmitter, the glass fiber, and a receiver that can simultaneously process voice, data, and video signals on the same transmission system. (Figure 19 is a diagram of how a fiber optics system operates.) The transmitter takes the coded electronic signal and converts it to the light signal, which is carried by the glass fiber to either a repeater or receiver. At the receiving end the signal is detected, converted to electronic pulses, and decoded to the proper output. This output could be voice, video, or data, depending on the end receiver. (Tariyal and Cherin, 1989)

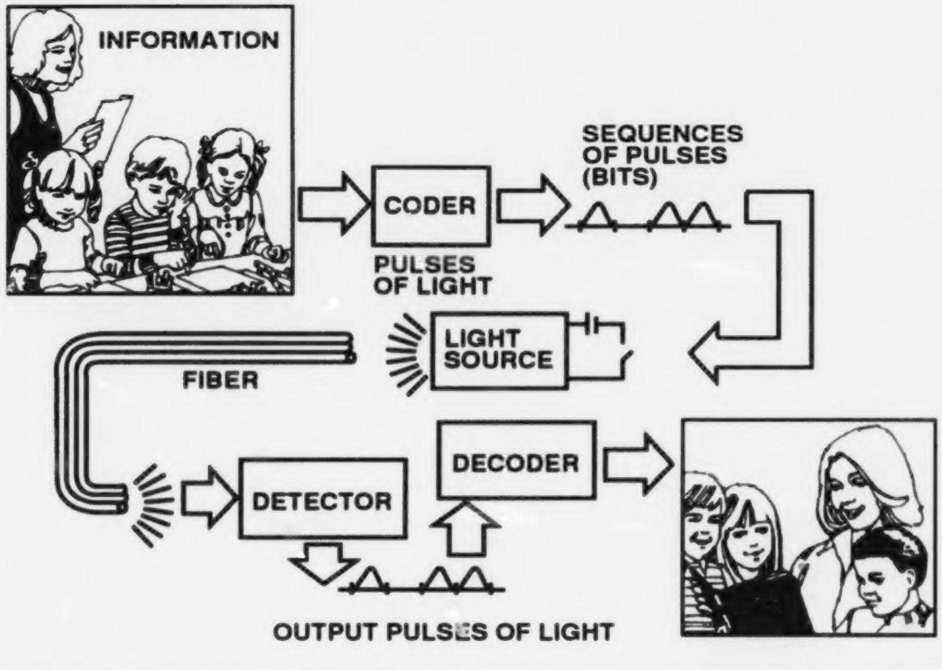
Each glass fiber, as small as a human hair, can carry up to 24 analog television channels. This means that, using analog transmission technology, there could be eight three-site connections providing eight classes to 16 remote sites at the same time. This same fiber can carry as many as 64 digital television channels. Recent advances in laser technology have made it possible for one fiber to transmit one billion bits of information each second. This speed is equivalent to the transmission each second of either 20 digital television channels, 14,000 telephone conversations, or 100 average-length novels. (Wedemeyer, 1986)

Fiber optics transmission is attractive for several reasons.

- Glass is more plentiful than copper.
- The small size of the cables increases the capacity of ducts that are now crowded with conventional cables.

Figure 19

Schematic Diagram of a Lightwave Communications System



Source: Tariyal, B.K., and A.H. Cherin. "Optical Fiber Communications." *Encyclopedia of Telecommunications*. San Diego, CA: Academic Press, 1989, p. 236.

- All forms of electrical interference are eliminated.
- The potential for multisignal transmission far exceeds that of electrical cables.
- The low resistance (or attenuation), even at very high frequencies, reduces the number of amplifiers required to deliver signals over very long distances. (Dordick, 1989, p. 467)

The original signals a fiber optics system delivers can originate from a satellite. Fiber optics coverage can be point-to-point or point-to-multipoint, traveling more than 20 miles without repeaters and much farther with specialized equipment. Other equipment necessary for this type of system includes FM modulators and demodulators at each site, optical transmitters and receivers for analog systems, and codecs for digital systems.

The channel capacity of this technology is limited only by the number of fibers and advancements in receivers and transmitters. The system also can be easily expanded to include audio and data transmission. Fiber optics transmission is completely unaffected by weather and less subject to noise and interference than copper cable transmission. An increasing number of utilities and telephone companies are installing fiber optics to upgrade their telecommunications infrastructure. Thus, this technology offers attractive opportunities for business and education partnerships that might be able to lower the costs to the schools for this very expensive technology. (Kitchen, 1989)

Until 1970, long-range fiber optics communication systems, for the most part, were impractical. Since then, however, remarkable advances have taken place in the development of supertransparent glass fiber. Improvement of the fibers, coupled with new signal input and output devices, has made fiber optics communications one of the fastest growing areas in the communications world. Figure 20 is a map of the state that details fiber optics projects for education in Wisconsin.

Modes of Instruction

Advantages of two-way interactive distance learning—whether transmitted over fiber optics, point-to-point microwave or ITFS, or cable television systems—include the following:

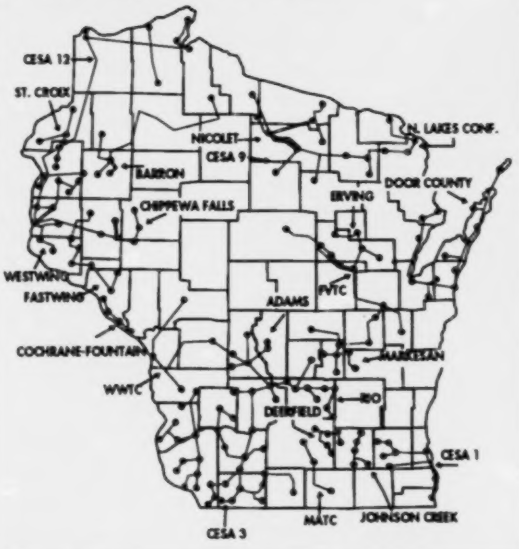
- Two-way, full-motion video can be transmitted among all sites, allowing students and teachers to see each other.
- Most systems currently operating are small networks that promote local control of the teacher and the curriculum and generally maintain small class size.
- Open microphones allow for full interaction between students and teachers as well as between students.
- Most signals over current media are not affected by weather.
- Any site on the network can originate as well as receive classes.
- Unless required by law, the presence of a classroom facilitator at remote sites is typically not necessary because the teacher can see all remote sites at all times.

Disadvantages of two-way interactive distance learning instruction, regardless of the transmission system employed, include the following:

- Cable television and fiber optics are still not available in many rural communities, although they are slowly becoming more common.
- Fiber optics is very expensive to install.
- Virtually all successful two-way interactive television systems are founded on a partnership between schools and businesses in the local area,

Figure 20

Distance Education Fiber Optics Projects



Source: Evans Associates. *Wisconsin Distance Education Technology Study*. Madison: Wisconsin Educational Communications Board, 1993, p. C-1.

and the human resources and financial capital needed for a partnership like this are not available in many rural areas.

- Most systems require a large capital investment to pay for start-up costs.
- The technology does best as a small network, with the linking of additional sites being expensive and making it increasingly difficult to maintain the two-way "visibility" among all sites. (Barker, 1992, p. 37-41)

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Matching Needs with Technologies

5

Introduction

This guide has already discussed the origins of instructional telecommunications and distance learning and illustrated their use in classrooms in Wisconsin, across the nation, and around the world. It has also explained the various technologies used to deliver instruction in Wisconsin.

Chapters 5 through 9 present a strategic planning model for assessing instructional needs and matching those needs in the classroom with telecommunications technologies. These chapters discuss the necessity for an instructional telecommunications plan and include suggestions for organizing the assessment effort.

The planning model outlined in these chapters can lead school district personnel through a process of discovery designed to help them develop specific long-range plans to achieve their preferred futures. The model can show them how to design a process for continuously collecting, monitoring, and reviewing critical data. It discusses how to involve a broad-based group of stakeholders—school and community members—in planning for these technologies. Also described are ways in which these stakeholders can serve as key communicators in explaining specifics of the district's instructional telecommunications plan to the general public.

This guide discusses how broad-based activities can build districtwide ownership of and support for the instructional telecommunications plan. It explains how districts can determine specific goals and objectives to support the vision and mission statements that are part of this process. And it shows districts how to create a plan to secure what they want for the future.

Why Create a District Plan?

Every school district should develop a technology plan to guide its use of instructional telecommunications. However, the issues involved are complex, and planning for telecommunications technologies should be done very carefully. These are steps that need to be taken.

- List all courses of study the district currently provides as well as courses being considered for introduction into the district in the future via telecommunications technologies.
- Choose the types of instructional opportunities the district wants telecommunications technologies to provide, whether they are full-credit student courses, collaborative learning ventures between classrooms, or staff inservice and professional development programs.
- Identify potential providers of local, regional, state, or national instructional programs that can meet district needs and expand the current curriculum with courses it could not otherwise offer.
- Consider technologies currently available that could meet current and projected instructional needs.
- Research new and emerging technologies that could meet current and projected instructional needs.
- Calculate the costs associated with new instruction and equipment.

- Determine inservice training needed to help teachers effectively use instructional telecommunications in their classrooms.
- Assess the impact instructional telecommunications technologies will ultimately have on the fabric of the classroom and the school district as a whole.

As this guide has shown, new learning opportunities have been created by the proliferation of information resources, the growing need for information and lifelong learning skills, and the development of new technologies. Satellite, cable and broadcast television, computers, microwave, and fiber optics technologies are now capable of transmitting significant amounts of information in the forms of voice, data, and video.

All of this material can be sent directly to the classroom, library media center, workplace, or home. New technologies have given people who know how to operate them the power that comes from having access to large amounts of information. Educational organizations have also been able to harness these technologies to create new forms of instruction and to further communication among all members of the educational community.

Telecommunications technologies can affect, to some extent, how school districts operate, the characteristics of traditional classrooms, and the way teachers perform their jobs. The traditional role of a teacher is to lecture to a large group of students. But new technologies can shift that role to one in which the teacher facilitates collaborative, individualized, and small-group instruction. These technologies also enable teachers to extend their instruction to students in remote locations by means of voice, data, and video transmissions. Teachers can reach students in other sites across campus, in other school districts, or in other towns, states, or countries. The types of instruction they can offer range from a full-credit course for high school students to an enrichment program or a collaborative project with another class.

One reason planning is important is that instructional telecommunications technologies can be expensive. For example, it can cost as much as $24,000 to equip each classroom that is part of a fiber optics network. This price includes television monitors, switching devices for video and audio signals, microphones, and a teaching station. The teaching station itself must have a telephone, a computer, and a camera control unit to coordinate video between the instructional site and the remote classrooms. A fiber optics network is expensive because the equipment gives each classroom in the system the capability of originating as well as receiving instruction.

Prices are also high for some of the other technologies available. A satellite dish can cost between $5,000 and $10,000; a two-way Instructional Television Fixed Service (ITFS) classroom with three cameras, $28,000; and a one-way, full-production ITFS studio, as much as $90,000. Only one full-production studio is needed for a one-way video ITFS system. Although a two-way video ITFS system does not require a major production studio, each classroom must be equipped to both receive and transmit signals. An ITFS classroom that will only receive transmissions can be built for as little as $800 to $1,000. Such a facility requires an antenna to bring in the signal, wiring to the classroom, a television set, videocassette recorder (VCR), and a speaker phone. Costs could be considerably higher if a tower is needed at the school to receive the ITFS signal.

A computer with a modem can be purchased for between $1,200 and $2,400. However, it can be used by only one or two students at a time and long-distance telephone lines are needed to fully realize the capabilities and benefits of this technology. Few districts currently provide long-distance telephone service to their library media centers, much less to individual classrooms.

The costs mentioned so far are only those associated with the technology's hardware. Expenses for teacher salaries, student support facilities, tuition, consortium membership, user fees, facility construction, and maintenance will all increase budgets for an instructional telecommunications program.

Taking all these factors into consideration, it is of the utmost importance that school districts do not make decisions based only on the type of technology available in the district or desired by some of the users. Districts should, instead, create a strategic telecommunications technology plan based on the instructional needs of their students and the professional needs of their staff.

Purposes of a District Plan

A district's instructional telecommunications plan should be part of its total technology requirements and serve as a blueprint for the future. The plan should state the district's philosophy, mission, and vision for the future. The district must explain how implementation of this plan will affect curriculum and instruction, staff development, community involvement, and community education.

The instructional telecommunications plan should also describe the needs assessment process, the planning process, how the technology will be integrated into the district's overall level of technology, and the evaluation model used for assessment. The final section of a district instructional telecommunications plan should include the recommendations and broad goals, policies, and other procedural guidelines needed for implementation.

There are many actions that must be taken when creating a district plan for instructional telecommunications. Essentials of long-range planning for instructional telecommunications are as follows:

- allow sufficient time to develop the plan and complete all of its steps, while keeping in mind that planning is a continuous process;
- work with knowledgeable planners and process consultants;
- allocate sufficient resources to support the planning effort;
- develop a vision or strategic goal;
- collect, monitor, and utilize external and internal data throughout the planning process;
- modify or amend the plan as new data indicates the need for change;
- have the community members, staff, students, and other important constituents accept and support the plan by involving all crucial stakeholders in the planning process; and
- remember the keys to technology planning success are involvement and ownership by many. (Peterson, 1991, pp. 47-48)

Integrating Instructional Telecommunications

The planning model proposed for integrating instructional telecommunications into the classroom and school district is shown in figure 21. Each phase of this model will be reviewed separately in this guide. This model is taken from the Department of Public Instruction's *Guide to Curriculum Planning in Computer Education*. (Anderson, 1987)

The four major phases in the planning process will be discussed in separate chapters. They are

I. creation of a district plan (chapter 6),
II. implementation of that plan into a district program (chapter 7),
III. evaluation of that program (chapter 8), and
IV. modification of the plan and program (chapter 9).

Each phase consists of a complex set of activities needed to complete the task. Appendix F contains a checklist to help districts organize, plan, and implement an instructional telecommunications program. Although the basic planning model comes from the *Guide to Curriculum Planning in Computer Education*, its components are taken from several sources. While districts may adapt this model to fit local circumstances, it is recommended that all or most of the suggested steps be integrated into a district planning process. It is important to note that, even though detailed separately, some of these steps can and should be done simultaneously.

This model is focused at the district level, but it can easily be adapted to plan projects for a building, region, or an entire state. Simply translate personnel, resources, and activities into roles and resources appropriate for the level at which the planning model is used. For example, in creating a plan at the building level, the steering committee should consist of building-level administrators, representatives from each department and student support area, students, and parents. If desired, district-level representation may be added.

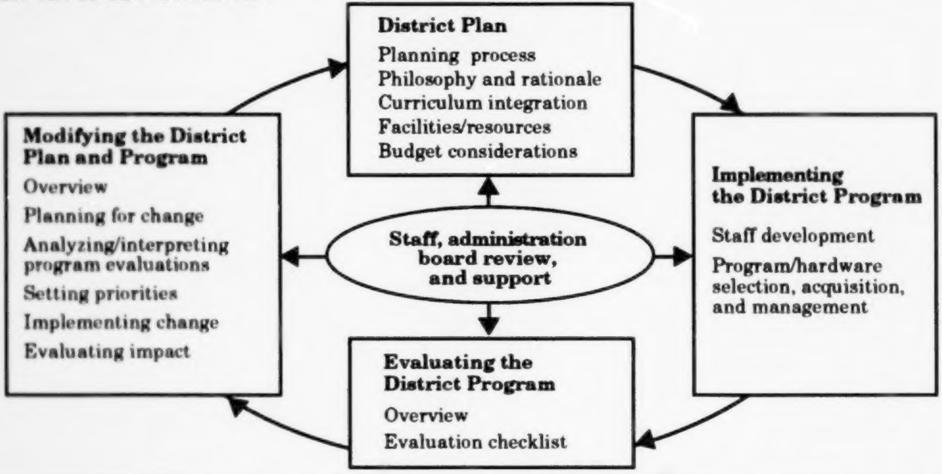
If this model is adapted to create a regional-level plan, the steering committee should include representatives from each district's administrative and instructional staffs, as well as from regional units such as cooperative educational service agencies (CESAs) or consortiums. A second group of participants consisting of district personnel will be needed to conduct the activities in each participating school district. The steering committee must coordinate the work of these district groups. The aggregation and analysis of the individual school district reports can be used as the basis for the regional report and plan.

One of the basic components of this planning model is a needs assessment that looks at both instruction and technology. The model defines a

Figure 21

Planning Process

This diagram summarizes a suggested planning process for integrating instructional telecommunications into the K-12 curriculum.


District Plan
Planning process
Philosophy and rationale
Curriculum integration
Facilities/resources
Budget considerations
Modifying the District Plan and Program
Overview
Planning for change
Analyzing/interpreting program evaluations
Setting priorities
Implementing change
Evaluating impact
Staff, administration board review, and support
Implementing the District Program
Staff development
Program/hardware selection, acquisition, and management
Evaluating the District Program
Overview
Evaluation checklist

Source: Anderson, M. Elaine. *A Guide to Curriculum Planning in Computer Education*. Madison: Wisconsin Department o Public Instruction, 1987, p. 14.

need as "the discrepancy between what is and what ought to be." That is, a need is the difference between a district's current status and what that district wants it to be in the future. Consequently, this needs assessment includes the process of identifying a district's vision of the future as well as assessing the present. If there is no difference between the two, there is no need that must be realized.

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The District Plan 6

The Steering Committee

Developing a district plan for instructional telecommunications is the most time-consuming phase of the planning model recommended in this guide. (See figure 22 for a physical representation of this model.) The first step is selection of a steering committee to be responsible for ensuring that major steps in the planning process are completed.

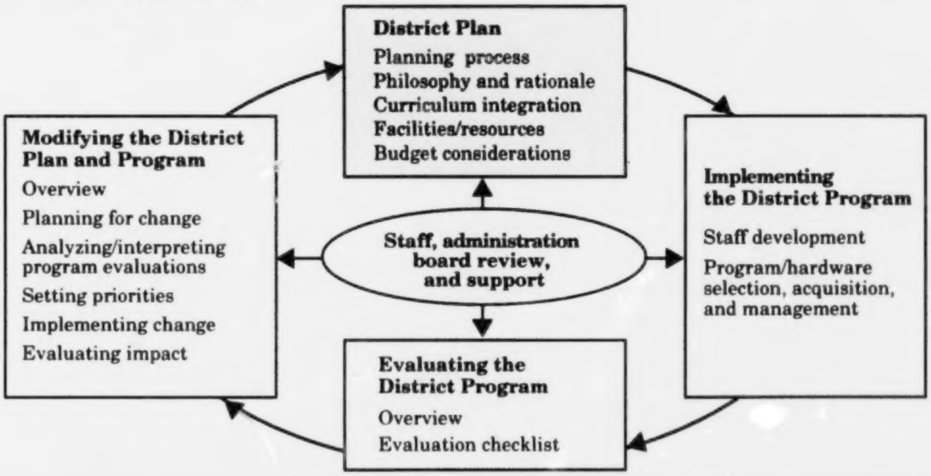
Members of the steering committee have many roles and duties including managing the planning process, defining its goals and objectives, and conducting instructional and technological needs assessments. The steering committee should be limited in number, but at a minimum should include

- the district administrator or representative;
- a principal (or representative) from each building in the district;

Figure 22

Planning Process

This diagram summarizes a suggested planning process for integrating instructional telecommunications into the K-12 curriculum.


District Plan
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Staff development
Program/hardware selection, acquisition, and management
Evaluating the District Program
Overview
Evaluation checklist

Source: Anderson, M. Elaine. *A Guide to Curriculum Planning in Computer Education*. Madison: Wisconsin Department of Public Instruction, 1987, p. 14.

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- the district curriculum coordinator;
- the district library media director or a school library media specialist;
- the district computer coordinator or other technology teacher;
- classroom teachers, preferably from each level—elementary, middle, and secondary;
- guidance counselor(s);
- the president, or a representative, of the teachers' union;
- school board member(s);
- student representative(s); and
- parent(s).

The steering committee will have overall responsibility for directing, guiding, and evaluating the planning process. The steps committee members must carry out are

- writing a philosophy statement and rationale for undertaking the instructional telecommunications planning process;
- defining the scope of the instructional and technological needs assessments to be conducted;
- determining existing sources of information required to assess the district's instructional and technological needs;
- deciding what data has to be collected to complete the assessments;
- setting timelines to complete the planning process;
- developing the district's instructional needs report based on the assessments conducted;
- developing the district's technology needs report based on the assessments conducted; and
- creating an implementation process based on these steps, each of which is discussed in this chapter.

A Philosophy and Rationale

The philosophy statement should explain the motivations that led the district to instructional telecommunications, describe the assumptions and beliefs underlying the district plan, and suggest the general results it is intended to produce. This statement is necessary to focus and give direction to district efforts. It also communicates current thinking of district decision makers to staff, students, and the community. Thus, it can be instrumental in developing support for instructional telecommunications.

A good place to start is to examine the district's current statement of philosophy. The steering committee can then determine how adequately it addresses the incorporation of telecommunications technologies into the district's instructional program.

The philosophy statement on the district plan could include any or all of the following elements:

- A statement about the mission of the school district.
- Assumptions about the future.
- "Why use" technology statements.
- "We believe" statements.
- A list of generalized concepts. (Minnesota Curriculum Services Center, 1983, pp. 9-13)

Mission Statements

Mission statements can be as simple as, "The mission of the public schools in the XYZ School District is to help all children in our community develop to their fullest potential." Or these statements can specify the *who*, *how*, and *why* behind the district's mission. An example of this kind of statement is, "The mission of the XYZ public school district is to provide the best education to the children of this community. The quality of this education is dependent upon hiring the most qualified teachers, purchasing the best equipment, and financing the best instructional and co-curricular programs possible. This is necessary to ensure that all children will have the opportunity to develop their cognitive, physical, and emotional capabilities to the best of their abilities, so they can become productive members of this community and this state." (Minnesota Curriculum Services Center, 1983)

The mission statement can also paint a larger picture of the district's philosophy and explain how it can be put into operation. There are many types of questions a committee can consider in seeking a broader portrait of the district's mission and philosophy. Here are a few examples.

- What makes this school district special? (What is the "culture" of the district? How is it maintained?)
- Does this school district provide innovative classes within fiscal restraints? (What are its successes and failures?)
- Does this school district provide programs for underserved or unserved students?
- Does this school district meet state requirements? (What is the district's compliance with state standards?)
- Does this school district provide quality education to all segments of the student population?

(What is the district's reputation with its neighboring districts? How does it perform on state-level testing programs?)

- Does this school district share resources with other communities and incorporate local business and industry resources into the educational experience? (Kitchen, 1989)

Assumptions about the Future

The district philosophy may incorporate assumptions about the future concerning changes in society that may result from technological advances. An example of this type of statement is, "The transformation from an industrial society to an information society will be one of the most overwhelming forces for change people have ever experienced." Or assumptions might be tied more directly to the new, more powerful forms of communication themselves, such as, "Technology will become increasingly powerful, versatile, inexpensive, and pervasive."

Assumptions could also consider changes in educational philosophy brought about by the availability of increasing amounts of information. An example of such a statement is, "Knowledge will grow at an exponential rate, primarily driven by two major forces: dramatically increased ability to tap and expand human intellectual potential; and enhanced use of multiple interactive technologies to manage, access, and utilize information." (Minnesota Curriculum Services Center, 1983)

These assumptions could also be based on an analysis of what is happening to educational policy and reality now, and what will happen in the future. Here are questions that can help clarify these assumptions.

- In what areas are innovations occurring—in the classroom, administration, educational technology, the library media center, the role of the teacher?
- What issues are the trends affecting—collaboration, school consolidation, privatization, school and business partnerships?
- In what direction are education in general, and educational reform specifically, headed—choice, school-to-work transition, postsecondary school options, classrooms without walls, learner outcomes, global education?
- What are the demands on the educational system, both now and in the future—demographic changes in the district, future tax base, special population needs, staffing shortages?
- What is important for students to know in a global, information-based society—foreign languages, telecommunications skills, geopolitical studies rather than world history, environmental and consumer education? (Kitchen, 1989)

"Why Use" Technology Statements

"Why use" technology statements offer a rationalization for incorporating new technologies into a district's instructional program. They can include many different ideas and philosophies. Here are just a few: "Technology use can prepare people for a world in which contact with technology applications will be a daily occurrence"; "Technology use can increase the opportunities that community members will have for continued learning"; or, "Technology use can improve the management of learning programs and resources, making them available to community members." (Minnesota Curriculum Services Center, 1983)

"We Believe" Statements

"We believe" statements offer insights about the feelings district officials have concerning instructional telecommunications. They can contain thoughts such as, "There is a need to focus efforts on using technology to improve instruction and student achievement in writing, mathematics, problem solving, social studies, and so forth." Other ideas that can be expressed are: "Students from this district should have equal opportunity with others when competing for jobs requiring the use of high technology"; or "The district should make a financial commitment and provide leadership support for the use of technology by teachers and for the instruction of students." (Minnesota Curriculum Services Center, 1983)

Other Generalized Concept Statements

There are other generalized concept statements that do not fit into any of the other categories. Here are some examples.

- "Technology is a means, not an end; it is a resource for instruction and facilitates the learning process."
- "Educational technology can be used to address the full spectrum of learning styles, rein-

forcing and promoting all learning levels from knowledge, skills, and attitudes, to synthesis, evaluation, and application."

- "Educational technology will assist in providing educational opportunities for people of all ages residing in the district, affirmatively addressing the needs of special populations, including females, minorities, and the disabled." (Minnesota Curriculum Services Center, 1983)

The Instructional and Technological Assessments

The scope of the instructional and technological assessments will be based on the philosophy and rationale developed by the steering committee. Assessments can be done at the building, district, or state level. They are also possible for regions consisting of several nearby school districts or an entire cooperative educational service agency (CESA) area.

The scope of such an assessment can also be specific to a single grade level; a curriculum content area such as math, science, social studies, or foreign language; or special programs such as Exceptional Educational Needs (EEN), gifted and talented, Title I, at risk, or English as a second language (ESL). The assessment could include any combination of these areas and grade levels.

While it is somewhat unlikely that a district would conduct a state-level or even a CESA-level study of instructional telecommunications, this model can be used to gather data to respond to such studies. It can be adapted to meet any planning process at any level and can even perform simultaneously on multiple levels.

The Instructional Needs Assessment

There are five steps necessary to conducting a comprehensive assessment of the instructional needs of a school district.

Step One

Determine the existing sources of data and information. In the first step the steering committee must determine existing sources of information and data available to assess the district's instructional needs. As the definition of "needs assessment" implies, it is essential to know the district's current status instructionally. The "need" is the discrepancy between the existing curriculum and what is desired in the future.

The following are examples of existing data and information resources that could be part of the assessment:

- current and projected student and staff demographic profiles by district, building, grade level, and subject area;
- current, past, and projected student course enrollment patterns by district, building, grade level, and subject area;
- exceptional needs plans or studies in progress for such populations as at risk, EEN, and gifted and talented students by district, building, grade level, and subject area;
- staff development and inservice needs by district, building, grade level, and subject area;
- annual Wisconsin Educational Standard (k) written curriculum reports;
- annual school district budget reports;
- annual Wisconsin Educational Standard (o) performance disclosure reports;
- School Evaluation Consortium (SEC) evaluations;
- student audits;
- other ongoing curriculum work;
- other Wisconsin Educational Standards review reports;
- annual standardized test results; and
- any other source the steering committee decides is relevant.

Step Two

Identify the data that has to be collected. In step two the data to be collected is identified and the steering committee explains why this information is needed. This step is important, because it matches the data elements to be measured with the rationale for the planning process. This rationale should call for listing the district's current instructional offerings and gathering staff, student, and community opinions about the future composition of the curriculum. Such an instructional profile should include information on course offerings, student support services, and program support resources. This step also should involve consideration of the professional development and inservice needs of district staff.

In this step the committee may also identify needed data elements that are not currently collected or available locally. They might be contained in annual reports submitted to the

Department of Public Instruction or in a survey of high school graduates tracking the impact of the school's curriculum on their postsecondary school life. Data collection can be done by district, building, grade level, and subject area. Falling within the scope of such data collection might be information about

- current instructional course offerings;
- student support services, including guidance and counseling, reading labs, gifted and talented, and so on;
- program support resources such as library media services, computer labs, ratio of computers to students and faculty, and so on; and
- professional staff development and inservice activities.

It is necessary to find out both where existing data is located (at district offices, school buildings, or other sites, for example) and how to collect it. The steering committee must also determine if it wants to collect new information through interviews, surveys, database searches, or any combination of these techniques.

Finally, an effort should be made to determine the staff and project support resources needed to conduct the needs assessment. These resources should be identified by district, building, and, if appropriate, grade level and subject area.

Step Three

Create a vision for the future. In step three districts should create a vision for the future, elements of which can be gathered in two distinct ways. The first is to have staff, students, and community members complete a written survey designed to gauge their support for the district's current instructional program. People who respond to the survey should have a chance to identify a "wish list" for future instructional and technological offerings. The vision statement is then compiled from these written responses and returned to the different constituencies for review and comment. This can be done on paper, or in an open meeting, to give representatives from each group another opportunity to voice their opinions. An open meeting can be held for each constituency or for the school district as a whole.

The second method of creating a vision of the future is to first solicit input from staff, students, and community members at open meetings conducted throughout the district. A statement can then be drawn together from this data. The draft vision can be reviewed during a second round of open meetings or published for written review.

Each method gives the three main constituencies a chance for input and review while also creating exposure and building support for the plan. Either way, it is important to obtain as much feedback as possible from all three groups to ensure a broad level of support for this vision. Staff must put the plan into operation, students must recognize that the plan is meaningful to their future, and the community must financially support the plan through local tax levies and other participation. The actual issues that need to be considered are discussed and examined in the final step.

Step Four

Set timelines. In this step, districts should develop timelines to complete the assessment. The first timeline should set the completion date for the plan to meet local, state, and other reporting, budget, and funding cycles. The steering committee also needs to set timelines for collection of data so that information can be aggregated, interpreted, and analyzed to meet the plan's completion deadline.

It is important to know how this instructional telecommunications plan fits into various reporting and funding cycles, because a district may have to delay carrying out parts of the plan if it misses a particular deadline. For example, state-level funding cycles are biennial while those for local school districts are annual. In addition, if a school district is seeking funding from foundations or grant programs, it should be warned that deadlines may arrive periodically during the year.

For example, if state-level funding is the source of financial support, the plan must be ready for presentation to the appropriate state agencies at the time they are working on the next biennial budget. Otherwise, the district may have to wait until the next budget cycle to secure funding. If the instructional telecommunications plan is part of a school district's overall construction project, it must fit into the planning, reporting, and budgeting timelines of the building program.

Step Five

Develop an instructional needs report. The final step is development of an instructional needs profile for the district. This step occurs after the status of the current instructional program has been verified, needed data identified and collected, and the vision for the future created. At a minimum this needs profile should answer the following questions:

- What instructional programs or courses should be added at the classroom, building, or district levels to bring curriculum in compliance with building, district, state, and national standards?
- What instructional programs and resources could be used to increase learning opportunities in the district, building(s), and classroom(s)?
- What instruction is needed to provide for low-enrollment classes, English as a second language instruction, special education, enrichment programs, and advanced placement courses for gifted and talented students?
- What are the most critical staff development or inservice needs for teachers, support service staff, and administrators?
- What local, regional, state, or national program or service providers would the steering committee like to utilize in its classrooms, buildings, or district to address the needs that have been identified?
- What instructional programs or student and staff support services are currently offered on a shared basis with other school districts, either directly or through a CESA?
- What postsecondary education institutions (Wisconsin Technical College System, University of Wisconsin System, and so on) currently provide the district with instructional programs or staff development and student support services?

The Technology Needs Assessment

The technology needs assessment may be conducted at the same time as the instructional needs assessment. The instructional telecommunications technologies assessment instrument in appendix F can be modified to collect information at district, building, and classroom levels. Data collected on classrooms should be aggregated for a profile of individual school buildings, while information from individual buildings can be used to assess the district's overall instructional technologies. If a district is participating in a regional or state planning process, the district profile can be aggregated with those of other units in the study for a regional picture of instructional technology.

In addition to being an inventory of current technologies, this assessment also considers how technologies are used instructionally and administratively at each level. It is important to gather information in this way to emphasize that the technologies themselves are not what is important, but rather how the technologies help meet instructional and administrative needs in the classroom(s), the school building(s), and the school district.

These are the steps for performing a technology needs assessment as part of the district planning process.

- Conduct a comprehensive inventory of all telecommunications and computer hardware used both instructionally and administratively in each district office, school building, and classroom.
- Conduct a comprehensive inventory in each building in the district, both instructionally and administratively, of all classes, programs, software, and resources linked to existing technologies. Then aggregate the data for each building for a district inventory.
- Assess the availability (locally, regionally, statewide, nationally, or globally) of technologies not currently used by the district. These could include upgrades or networking of the installed computer base in the district, construction of an Instructional Television Fixed Service (ITFS) system or fiber optics system in the region, or local cable television.

Creating an Instructional Telecommunications Plan

The instructional telecommunications plan for the district is based on the two assessments already discussed in this chapter. The district plan, which includes a range of alternatives, identifies specific strategies for matching current instructional needs and technology resources with future instructional needs and technology acquisitions.

This plan should identify several time frames for implementation including a short-range span of one to three years, a medium-range period of four to seven years, and a long-range schedule of eight to 12 years. The length of these particular timelines may not meet the needs of specific districts and can be adjusted accordingly. It is important to realize that instructional telecommunications technologies are evolving at an extremely rapid rate. Thus, these plans need to be flexible because they may be more subject to change as the implementation time period gets longer.

Short-range goals should outline a district's early steps through the purchase of components for the basic technology infrastructure and instructional telecommunications technologies themselves, such as televisions, videocassette recorders (VCRs), and speaker phones. These goals should also focus on training staff to use these technologies and beginning the process of integrating instructional telecommunications into the fabric of the curriculum and school district.

Medium-range goals include continued purchases of technology to finalize construction of the district's telecommunications infrastructure. Long-range goals should cover completing the purchase of technologies and fully integrating new instruction into the district's curriculum and operations.

There are several steps that should be taken in this part of the planning process. The first is to identify issues concerning curriculum, technology, and administration raised by each of the strategies considered in the plan. Planners can use the strategies assessment sheet on the next page for help with identifying issues.

An effort should also be made to determine if currently available local technologies or program providers would help a district or building to meet its needs. Are the courses intended for remedial, average, or advanced students, or for a combination of all three types of learners? Does the instruction meet state certification requirements? Are there programs for student enrichment, college preparation, or advanced placement? Are there classes that help students prepare for standardized tests like college entrance examinations? Are teacher and administrative inservice courses or adult education classes offered? (Barker, 1992)

The planning process must determine if other technologies or program providers not yet available locally would help a district or building to meet its needs. There are many questions to be answered in considering new sources of instruction. Does the distance program provider schedule enough time each semester for makeup work? How many days each week does the system or program provider conduct classes? Can classes be videotaped and viewed later by students who miss a class or portions of a class? Are some lessons prepared in advance for broadcast in the event the distance teacher is unable to conduct the class live? Does the distance teacher have office hours so students can make contact when lessons are not being conducted? How early or late in the school day are courses conducted? How closely aligned are the distance course or program schedule and the district school calendar? (Barker, 1992)

Articulating Curriculum

The district plan should identify a process for articulating new instructional content provided by telecommunications technologies with the scope and sequence of current curriculum. The plan should also address the correlation of enrichment resources, programs, and activities with existing instructional elements. This articulation should also include professional development for staff, administrators, and members of the school board.

There are many questions that must be answered to make this determination. Here are just a few to consider.

- Is the content appropriate for the intended grade level?
- Does the course or program contain appropriate and easy-to-follow instructions? Does the course or program contain clearly and completely stated learner goals and objectives, and do these goals and objectives match those established in the district for this subject area?
- Does the course or program use primary and secondary materials and teaching methods that are exciting, motivating, and varied? Does it meet the needs of the students and adjust for individual differences in abilities, desires, and interests?
- Does the course or program contain accurate and up-to-date content? Is the content clear, consistent, and well-organized?
- Is the pace logical and flexible, especially when taking into consideration the characteristics of the technology with which the instruction is delivered?
- Does the course or program provide for fair, accurate, and appropriate evaluation of student performance and progress? Does it contain pretests and other diagnostic procedures?
- Does the course or program connect in a clear and appropriate manner with other courses, sub-

Curriculum, Technology, and Administrative Issues

An instructional telecommunications plan should describe various strategies for matching current instructional needs and technology resources with future instructional needs and technology acquisitions. Once that step is completed, planners can use these questions to help them identify curriculum, technology, and administrative concerns that might be raised by implementing those strategies. The source for questions listed is "Emerging Technologies: A Roadmap for Librarians," an article by Marilyn Kemper that appeared on pages 36 to 41 of the Nov. 1988 *School Library Journal*.

1. Have teachers been involved in development of the plan so they have a sense of ownership in the process?
2. Do technologies identified in the plan facilitate types of instruction that address district needs?
3. Does the plan provide inservice training for staff, students, and administrators on new technologies and the instruction they deliver?
4. Does the plan describe a process for coordinating curriculum planning among subject areas in a building, among buildings in a district, or among districts within a consortium?
5. Does the plan establish procedures for reviewing curriculum and evaluating teaching that occurs over these technologies?
6. Does the plan identify support staff who can repair and replace equipment or who can help manage the flow of student assignments and records?
7. Does the plan ensure equal access to these technologies for all students and staff?
8. Does the plan discuss the effects that policies about class size limits, student selection, and course selection may have on instruction conducted over these technologies?
9. Does the plan provide back-up procedures in the event of technical failure?
10. Does the plan call for sufficient instructor-learner interaction using voice, data, and video technologies whenever that is possible or appropriate?
11. Does the plan take into account state-level guidelines or rules addressing instructional telecommunications?
12. Does the plan have any conflicts with provisions of the current teacher contract?
13. Does the plan consider student and class scheduling conflicts that may arise through use of these technologies?
14. Does the plan consider its effect on the school bell schedule and district school year calendar?
15. Can total costs be determined, including equipment acquisition, new facilities, and maintenance?
16. Will use of technologies proposed in the plan result in an annual savings over current instruction?
17. Does the plan identify current staff members skilled in implementing, operating, and maintaining the new technologies?
18. Do administrators have the necessary expertise to manage and supervise plan activities?
19. Are staff, students, and the community likely to support the plan?
20. Do key decision makers display a positive attitude toward the plan?
21. Is support for the technologies widespread or confined to a few individuals?
22. Are staff and administrative expectations concerning benefits of the plan reasonable?
23. Is the organizational structure flexible enough to deal with any disruption triggered by the installation and testing of the technologies?
24. Is there a formal mechanism for handling procedural or policy modifications necessary to accommodate changes caused by the plan?
25. Is there a designated authority who has responsibility for implementing, maintaining, and operating the technologies?

ject matter, and grade levels already established in the district? Does it employ clear record keeping practices that are accurate and meaningful?

- Does the course or program employ technology appropriate for the content presented and for the learners' abilities? Does the technology interfere with, or does it enhance, the content and the learning process? (Barker, 1992, p. 13-14)

Calculating Costs

Another function of the planning process is calculating a budget to purchase instructional telecommunications technologies and to participate in new courses, programs, and activities. There are five categories of cost that must be taken into consideration—capital, development, operation and maintenance, expansion, and miscellaneous.

Capital costs pay for the acquisition of the technology itself, whether it is a television set, satellite dish, computer with a modem, or a complete television studio. They decrease when amortized over the life of the equipment or facility that is required.

Development costs are those needed to put the district plan into operation. These may make the plan more expensive in its first year of operation and are easy to underestimate. Typical needs include recruitment and training of master teachers, development of the program and accompanying materials, and reproduction and distribution of materials. There are also start-up expenses for evaluation planning, record keeping and clerical support, management, and miscellaneous supplies and equipment.

Operation and maintenance costs are those necessary to keep the system functioning. These include equipment service and repair, purchase of expendable materials, salaries for aides or monitors, student transportation, administrative and coordination expenses, tuition, and fees.

Expansion costs are incurred to increase the number of students or the size of the program. These normally include the purchase or rental of new equipment, increased management, new staff, expanded delivery systems, and publicity and public relations.

Miscellaneous costs are associated with the time and energy needed to plan, develop, and implement a technology plan. They could also include the social costs of staff dislocation, the confusion (and sometimes hard feelings) fostered when procedures and behaviors must be changed, and the need to explain new programs to the community and to gain its support. (Batey and Cowell, 1986)

Identifying Financing Options

Another important component of the planning process is to identify possible methods of financing the purchase of technologies and implementation of the plan. A district may consider joining a local, regional, or national consortium to share costs of instruction, programming, and technologies.

Such groups may be based on specific technologies, such as fiber optics, ITFS, or satellites, or they may be consortiums linked to instruction from specific sources. The latter include instructional television (ITV) services provided by Regional Educational Telecommunications Areas (RETAs), programs from the Satellite Educational Resources Consortium (SERC), CESA-shared teachers, advanced placement (AP) courses and staff inservice or credit courses from postsecondary schools, or teleconferencing services from the Wisconsin Technical College System's WisConLink network.

The plan must also address whether the district should seek funding from state, federal, or private foundations to finance new technology and to pay for participation in new instructional programs and activities. Funding sources include the following:

- Federal Elementary and Secondary Education Act (ESEA) Chapter 1 (special education needs for disadvantaged children);
- ESEA Chapter 2 (block grant funds for innovative projects);
- Star Schools Grants and special equipment grants from the Rural Electrification Agency (REA), SERC, the National Telecommunications and Information Agency, IBM, Apple Computer Corporation, and local telephone and cable television companies;
- local and national foundations that fund innovative school projects, such as the Kellogg Foundation; and
- special state legislation. (Cromer and Steinberger, 198[illegible]

In addition, the school district might consider entering into local school and business partnerships to finance technology purchases and participation in instructional programs. Local business and school partnerships with the REA, agricultural cooperatives, local cable television system operators, and local telephone companies are all possibilities to explore. Partnerships can help schools or districts purchase satellite dishes, gain access to cable television channels and programs, and conduct fiber optics studies. Some of these partnerships provide all or part of the funding for one or more technologies.

Finally, an effort should be made to construct a cost-benefit analysis for each alternative technology strategy identified in the plan. Traditional methods of calculating the cost effectiveness of an educational program may not be applicable to instructional telecommunications programs. Costs in these programs are generally a function of the amount and type of content to be presented, the size and location of the audience, the choice of media, and the sophistication of the product. Typically, expenses over and above those for delivering traditional instruction will include capital costs as well as those for development, operation or maintenance, and expansion.

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Implementing the Plan

7

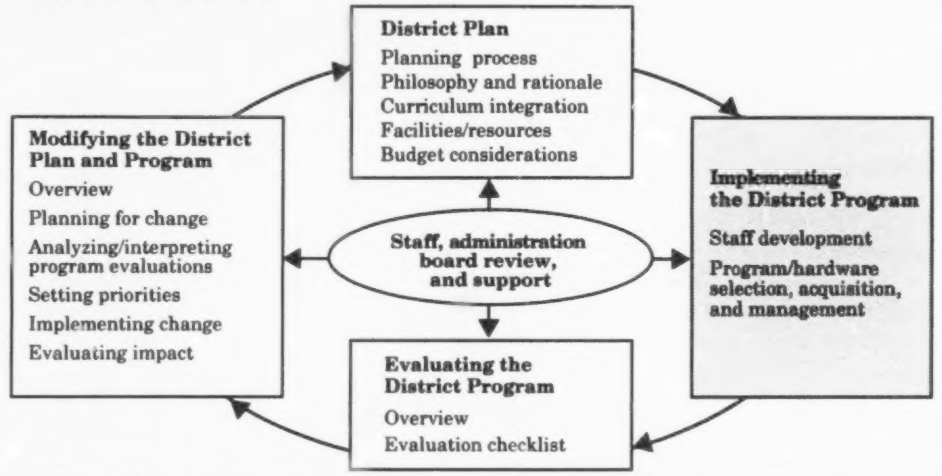
Once the district plan has been written, reviewed, and authorized by the school board, the next step is its implementation. Activities in this phase are similar to those in implementing any other project in a school district. However, because this plan will affect a major portion of the staff and instructional programming already in place, records should be kept so every action taken can be evaluated. An effective implementation process will include the following:

- writing a district policy dealing with instructional telecommunications;
- creating procedures to inform all parties involved about the district plan and implementation process;
- conducting district orientation and staff development programs for all involved;
- selecting district and building implementation teams; and

Figure 23

Planning Process

This diagram summarizes a suggested planning process for integrating instructional telecommunications into the K-12 curriculum.


District Plan
Planning process
Philosophy and rationale
Curriculum integration
Facilities/resources
Budget considerations
Modifying the District Plan and Program
Overview
Planning for change
Analyzing/interpreting program evaluations
Setting priorities
Implementing change
Evaluating impact
Staff, administration board review, and support
Implementing the District Program
Staff development
Program/hardware selection, acquisition, and management
Evaluating the District Program
Overview
Evaluation checklist

Source: Anderson, M. Elaine. *A Guide to Curriculum Planning in Computer Education*. Madison: Wisconsin Department of Public Instruction, 1987, p. 14.

- defining roles and assigning responsibilities for all aspects of the plan.

A District Policy

The first step toward an effective implementation process is to write a district policy covering all aspects of instructional telecommunications. It must address state statutes and administrative rules, high school graduation requirements, local policy and practice, current union contract provisions, and certification issues.

It is also important that the policy consider which staff members will be responsible for implementing the instructional telecommunications plan at the district and building levels and for managing the purchases, contracts, and financial agreements this plan dictates. This policy must address who will enroll students for telecommunications-based classes and who will schedule these classes into the school day. It also assigns the responsibility for recruiting, training, and paying distance teachers and classroom facilitators.

The district policy must include a mechanism to evaluate the performance of distance teachers and classroom facilitators involved in instructional telecommunications. It will also detail supervision of distance teachers and classroom facilitators and assign responsibility for supervising students in telecommunications-based classes. A procedure also has to be created for resolving any conflicts that arise concerning use of the new technology.

Officials must decide who will provide technical support to carry out the instructional telecommunications plan and implementation process, both in the district and in each school building. The policy will also set class size limits, if any are desired, and explain their criteria.

An effective implementation process also will include procedures to fully inform the school board, district staff, community members, and other interested groups about the instructional telecommunications plan and how it will be implemented. Districts need to effectively communicate details concerning this plan, both internally to district employees and students and externally to parents, residents, education groups, business and industry groups, and others.

Orientation and Staff Development Programs

Another component of the implementation process is creation of a district orientation program to introduce and explain the plan to district staff and the community. This includes establishment of an ongoing staff development program to teach staff how to integrate new technologies into their classrooms and how to teach with them.

The orientation program should be created by the steering committee. It should be presented to the public as well as district staff. The ongoing staff development program should be developed, under the direction of the steering committee, by the district staff development coordinator or a staff team created specifically for this purpose.

The District Orientation Program

The first step in creating a district orientation program is to discuss the instructional telecommunications plan itself. Talks should detail how this plan relates to the concepts of distance learning and instructional telecommunications and consider the plan's philosophy and rationale.

The orientation could then focus on the scope and findings of the instructional and technological assessments that were conducted, including how the district plan addresses instructional needs that were identified. The orientation should include an introduction to the full range of instructional telecommunications technologies available and their applications in the classroom. These technologies can deliver enrichment programs and activities to augment existing curricula, full-credit courses and other new learning experiences for students, and opportunities for staff development and community education.

Issues that should be examined include the effects of the instructional telecommunications plan on curriculum development; student selection and orientation for distance learning; access to learner support materials such as online databases, electronic card catalogs, and electronic mail; and new methods to teach students in remote classrooms. How this plan fits into provisions of the current teacher contract should also be evaluated. The orientation program should conclude with a review of the steps needed to implement the instructional telecommunications plan.

The district orientation could be presented in one all-inclusive, districtwide meeting in which staff members and the community could all participate. Or, the orientation could be held for staff first and for members of the community at a later date.

The district orientation could be presented to all staff members at one meeting or to smaller groups at individual schools during teacher inservice days. The orientation could also be divided into a series of presentations so that staff members could discuss one major element of the plan at each meeting. Either format could be adopted to inform the community about the district plan.

It is recommended that all employees, including support staff, teachers' aides, and custodians, take part in this orientation. All staff members will be affected by the instructional telecommunications plan and should have a say in its implementation.

District Staff Development Program

At the same time the steering committee is organizing the orientation, it should be creating or coordinating the start of an ongoing district staff development program. This will prepare staff members to use telecommunications technologies as another classroom tool and give distance teachers the skills, resources, and methodologies they need to be effective. This training could take place during teacher inservice days prior to the start of the new school year, during the school year, or during the summer as a paid staff development activity. Any combination of these time frames could be employed to educate staff on all aspects of the instructional telecommunications plan.

One of the first steps is to train teachers and classroom facilitators in how to manage the learning process in a distance learning environment. Some staff members will actively teach using the technologies, either as the full-course teacher or the co-teacher with the distance instructor. Teachers need to know how to facilitate student use of new technologies so students can expand their learning opportunities. Teachers must also be taught how to become learning partners with students who are actively engaged with new technologies. Sometimes, teachers may even have to understand the need for simply monitoring students and taking little or no part in the learning process. Regardless of what role they play, all teachers will have to acquire the skills to operate a variety of new technologies in their classrooms.

Staff members involved with instructional telecommunications classes will have to learn new teaching techniques that complement the new technologies. For example, they must learn how to organize and structure materials so that the instruction they present will "fit" the technologies. Teachers must be aware of the importance of preparing very detailed lesson plans well in advance of delivery. They also need to systematically pretest materials and explanations for appropriateness, clarity, and comprehensibility. Teachers should be taught how to pace and deliver lessons in a different manner from that of a traditional classroom, how to present lessons according to strict and inflexible time schedules, and how to create imaginative supplementary materials featuring activities that integrate social and emotional concerns with subject matter content.

Staff members must learn to teach in a classroom setting in which there may be no students physically present to respond to their instruction. They need to know how to handle new types of feedback from learners in remote locations, possibly over a variety of technologies and in formats previously unfamiliar to them, or even to cope with no feedback at all. They must also be taught new techniques for fostering student participation while delivering instruction over new instructional technologies. One way to do this is to employ special recognition techniques for the schools, classes, or individual students at the remote distance education learning sites.

Appendix D presents a set of questions and recommendations that can be used to prepare staff to teach using interactive television. They can also help staff adapt to other instructional technologies. The appendix includes guidelines that will enable districts to evaluate the presentation formats of program providers they may be considering.

Staff members who teach using instructional telecommunications technologies, as well as those facilitating their use in the classroom, will depend on different methods to help students take part in distance learning classes. They must learn how to create innovative ways to elicit student participation in a class that has multiple physical locations and how to deal with questions from remote sites. One technique is written communications sent by mail, ranging from personal letters to journals or logbooks. Other ways to create student-teacher contact are exchanges of audio cassettes; telephone contacts, regularly scheduled or "on demand"; student get-togethers, either face-to-face or via technology; peer tutoring systems; tutorial groups either in or out of school; materials that will help parents assist their children; and electronic mail.

Distance teachers and facilitators will have to find ways for students to access new learner support materials, such as remote databases, card catalogs, and print or electronic resources. And they will have to do this whether their students are in one or many physical locations.

One way to provide help and advice for distance learning students is to have them make a formal connection with a staff member in their school who teaches a similar course in the traditional way. This teacher could offer valuable aid to students who encounter problems in a distance learning environment.

In instructional telecommunications classes, students and instructional materials may often reside in multiple locations. Because of this, teachers and facilitators may have to develop new methods of providing student support systems that deal with the nonacademic part of instruction. This would include records, grades, homework, assignments, tests, research, guidance, and counseling. Since most students need support of various kinds as they begin and proceed through distance learning experiences, a distance teacher removed from the learner cannot provide the usual guidance and support available in the traditional classroom. Consequently, teachers need to develop alternatives to traditional instructional guidance. (Batey and Cowell, 1986)

Selecting District and Building Implementation Teams

The next step in this process is to select district and building teams to facilitate implementation of the plan. The implementation teams will help staff, administrators, and students integrate instructional telecommunications into every appropriate aspect of school organization and curriculum. The district-level teams should, at the very least, consist of a representative of district-level administration, the district library media director, the district instructional television (ITV) contact person, the curriculum director, the student support services director, the head of the teachers' union, the district instructional staff development director, and the building maintenance director.

One or more school board members, parents, and students can be added to the district-level team to represent their constituencies. The district-level group is responsible for coordinating all aspects of plan implementation. This team may include some of the same people serving on the steering committee and may have some of the same duties as that committee, although not necessarily.

Some districts may choose to reserve policy and oversight responsibilities for the district-level implementation team and make the steering committee responsible for coordinating the actual implementation activities dictated by the plan. In either case, the district-level team or the steering committee will work with building-level teams to ensure consistent, thorough, and accurate implementation of the plan throughout the district.

The building-level team has a dual set of responsibilities. It has to work with the district-level team to coordinate its implementation of the plan with the rest of the district. It also has to make sure all staff members at its site adopt and integrate instructional telecommunications technologies into their classrooms. This team should include building-level administration, the library media specialist, classroom teachers, department heads, student support services personnel, and maintenance workers. One or more school board members, parents, or students may also be added.

Defining Roles and Assigning Responsibilities

The final phase in designing the implementation process is to define roles and assign responsibilities for various aspects of instructional telecommunications at both the district and building levels. The district plan puts into place technologies and instructional practices that are long-term additions, so it is important to identify the roles staff members will play and assign responsibilities for the long-term operation of each aspect of the plan. These long-term responsibilities exist at both the district and building levels.

At the district level, one of the most important roles is that of districtwide coordinator for all ongoing instructional telecommunications efforts. The staff member who shoulders this responsibility must make sure all aspects of the plan are carried out as intended at the district and building levels. Some logical choices of existing personnel to carry out these important duties are the district administrator, assistant district administrator, director of curriculum and instruction, district library media specialist, district technology coordinator, district distance learning coordinator, or the district plan steering committee.

Another important responsibility is dealing with the ongoing coordination of selecting, purchasing, installing, and providing technical support and maintenance services for the new instructional technologies. The staff member who fills this role will coordinate all aspects of the technological part of the plan at the district and building levels. Logical candidates are the district library media director, district technology coordinator, district distance learning coordinator, district computer coordinator, or other district-level administrator or group.

A third responsibility is coordinating the ongoing staff development programs that orient and train personnel to integrate instructional telecommunications into their classrooms. This includes the creation and possible modification of the district program that trains and supports staff members as they adopt the technologies and infuse them into their classrooms. Because staff development will be ongoing and will reach into every school building in the district, this program might best be assigned to a committee. Nonetheless, personnel who might be considered to fill this role include the director of curriculum and instruction, the director of staff development, the district library media director, the district distance learning coordinator, or some other district-level administrator or group.

The same three basic sets of responsibilities apply at the school-building level. For instance, staff members who might act as the ongoing building coordinator for all instructional telecommunications efforts are the principal, assistant principal, library media specialist, computer coordinator, distance learning coordinator, or other technology specialist or interested individual.

Among staff members who might handle purchasing, installation, and technical support for the technologies in the building are the assistant principal, library media specialist, computer coordinator, distance learning coordinator, or other technology specialist or interested individual. Personnel who might be assigned to coordinate or provide the ongoing inservice programs in the building include the principal, assistant principal, library media specialist, computer coordinator, distance learning coordinator, guidance counselor, building inservice committee, or other interested individual.

There are many additional responsibilities for instructional telecommunications programs that must be assigned to various staff members. For instance, someone must be named to handle academic records, grades, and absences from distance learning classes. A decision must also be made about who will coordinate selection, scheduling, and registration for student courses, staff development, and special events.

References

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Evaluation of the District Plan and Implementation Process

8

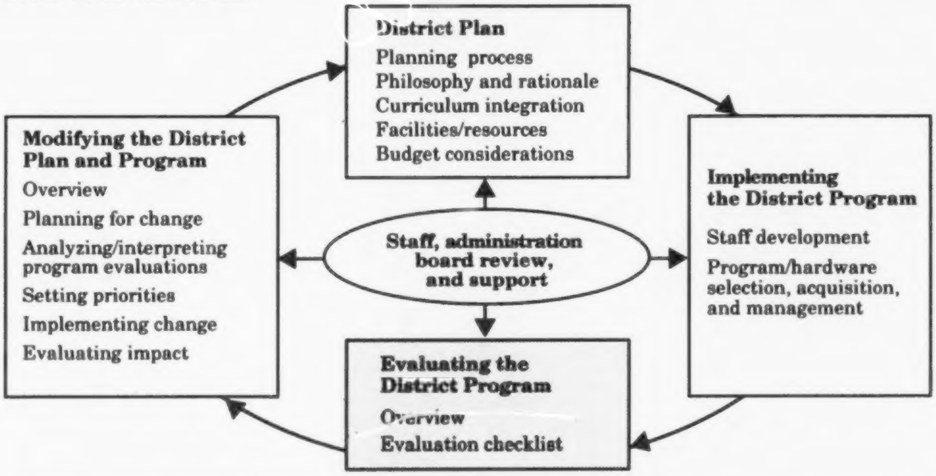
This phase of the planning and implementation process for integrating instructional telecommunications into the K-12 curriculum enables implementation teams to periodically measure progress toward the establishment, operation, and effectiveness of the plan elements. It also helps them determine how successfully the technologies have been integrated into the curriculum and how effective they are in helping students learn the course content. Evaluation practices in this phase even assess how well students are being taught the skills they need to use the technologies.

Evaluation should occur from the very beginning, and all parts of the implementation plan should be designed to be easily evaluated. Evaluation also should be ongoing. Evaluation results will help in deciding how to revise the plan and will provide appropriate information on the success of planning and implementation activities.

Figure 24

Planning Process

This diagram summarizes a suggested planning process for integrating instructional telecommunications into the K-12 curriculum.


District Plan
Planning process
Philosophy and rationale
Curriculum integration
Facilities/resources
Budget considerations
Modifying the District Plan and Program
Overview
Planning for change
Analyzing/interpreting program evaluations
Setting priorities
Implementing change
Evaluating impact
Implementing the District Program
Staff development
Program/hardware selection, acquisition, and management
Staff, administration board review, and support
Evaluating the District Program
Overview
Evaluation checklist

Source: Anderson, M. Elaine. *A Guide to Curriculum Planning in Computer Education*. Madison: Wisconsin Department of Public Instruction, 1987, p. 14.

Several things should be considered when designing a strategy for evaluating the implementation process. First, key participants in implementing the plan should be involved in developing the evaluation procedure. This group should include representatives of staff, students, and the community. Then a rationale should be established to explain the purpose of the evaluation and how the results will be used. It should also identify who will receive the evaluation information.

Three kinds of evaluation should be conducted. The overall implementation process itself should be analyzed, using both formative and summative evaluation techniques. There should also be an evaluation of how well staff have adopted and utilized instructional technologies and techniques in the classroom. The third area to be evaluated is the level of student learning that has occurred once these technologies and techniques have been put into place.

Evaluation of the Implementation Process

The implementation of the instructional telecommunications plan must be evaluated in two different ways. Formative evaluation looks at what progress has been made on the district plan while implementation is going on. The checklist in appendix F will help districts conduct this formative evaluation because it describes all of the steps and activities involved in creating and implementing the district plan. Not all of the activities identified in this checklist will have been included in every district's implementation plan. However, it is still a useful tool with which to evaluate implementation. Formative evaluation functions much as a flow chart does. It checks, for instance, whether a specific activity has been undertaken or a specific technology has been installed by the date dictated by the implementation process.

The second method that can be used to assess the implementation process is summative evaluation. This final evaluation of the implementation process takes place at the end of a project cycle. As outlined in step four of the needs assessment process in chapter 6, several types of timelines are set by the steering committee. Some are to meet periodic reporting deadlines, while others are to conform to predictable schedules such as annual and biennial budget cycles. Some of the predictable timelines could cover one-, three-, or five-year periods of implementation.

Summative evaluations typically look at the level of attainment at the end of each of these cycles and identify reasons why parts of the plan were not completed. Modification of the implementation plan is generally based on these kinds of evaluations, because they can summarize the degree of success or failure of a project at a particular point in time.

Evaluation of Staff Utilization

The second area to be evaluated is the extent to which staff are adapting curricula and using new technologies and instructional techniques in the classroom. Such an evaluation should review behavioral changes staff have made in order to deliver and manage instruction with new technologies and the ways course content or daily lesson plans are being altered to accommodate technological support. The instructional telecommunications plan is designed solely to meet the instructional needs of students and to provide staff with the tools to accomplish this objective. Thus, it is important to monitor the process of instructional content development. Districts must also assess test results to find out if new technologies are making a difference in the amount of information students learn and the number of skills they acquire.

Appendix E will help in evaluating staff utilization and conversion of course content to a technology-based delivery system. It details the basic requirements for preparing materials and presenting them over instructional television. These basic guidelines can be applied to content and basic delivery methods on, essentially, any instructional telecommunications technology. The specifics need only to be adjusted to match the particular characteristics of a given technology.

A variety of approaches can be used to gather information on staff utilization. Surveys and interviews with staff and students can evaluate levels of use as well as levels of satisfaction or dissatisfaction with the technologies and classroom teaching techniques. Questionnaires filled out by students, staff, and community members can measure how much understanding and support there is for the instructional telecommunications plan and the learning opportunities it has introduced into the school district. In addition, on-site observations by educators and technical experts in participating schools can help assess actual utilization at the learning sites.

A more time-consuming evaluation can be made by conducting an in-depth case study of one or more classrooms, departments, or school buildings in the district. This case study method, also known as an ethnographic approach, can require several months or even an entire school year to complete. It entails observing, recording, and reporting how a classroom, content area, or school building adopts, integrates, and expands its use of instructional telecommunications technologies. This method not only looks at the activities undertaken, but also the school building, classroom, and learning environments in which they take place.

Evaluation of What Is Learned

It is also necessary to evaluate the knowledge, skills, and attitudes learners have acquired as a result of the introduction of new technology into the instructional program. What students are learning will be evaluated through ongoing testing in the classroom and the district, including possible participation in statewide mandatory testing programs or high school equivalency diploma examinations.

Again, a variety of approaches should be used to gather the evaluation information. They can include surveys and questionnaires to check levels of satisfaction or dissatisfaction of students who are learning with the aid of these new technologies. Or, educators and technical experts in the participating schools can conduct on-site observations of student interaction with these technologies.

References

Anderson, M. Elaine. *A Guide to Curriculum Planning in Computer Education*. Madison: Wisconsin Department of Public Instruction, 1987.

9

Modification of the District Plan and Implementation Process

The fourth and final phase of the school district's effort to acquire and use instructional telecommunications effectively is modification of the district plan and implementation process. In the first, or planning phase, the path of the district's instructional telecommunications plan was defined and information was gathered to guide the high-tech journey to its end.

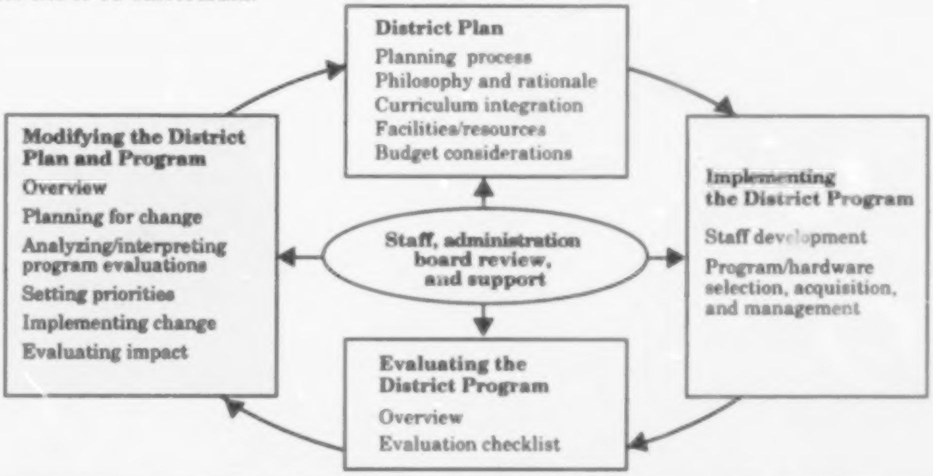
The second phase was the actual implementation of the instructional telecommunications plan. The implementation phase took into consideration the assessments of the district instructional and technological needs that were done in the planning stage. This second phase moved the plan off paper and into the realm of reality.

The third phase evaluated progress toward realization of the district plan and measured success in implementing the plan. It also gave district officials indications of areas in which efforts might have to be increased or changed.

Figure 25

Planning Process

This diagram summarizes a suggested planning process for integrating instructional telecommunications into the K-12 curriculum.


District Plan
Planning process
Philosophy and rationale
Curriculum integration
Facilities/resources
Budget considerations
Implementing the District Program
Staff development
Program/hardware selection, acquisition, and management
Evaluating the District Program
Overview
Evaluation checklist
Modifying the District Plan and Program
Overview
Planning for change
Analyzing/interpreting program evaluations
Setting priorities
Implementing change
Evaluating impact
Staff, administration board review, and support

Source: Anderson, M. Elaine. *A Guide to Curriculum Planning in Computer Education*. Madison: Wisconsin Department of Public Instruction, 1987, p. 14.

Phase four is the formal process of modifying the plan to better reflect the realities encountered in the implementation phase. The basic components for phase four include

- the plan;
- the short-, medium-, and long-term timelines; and
- the implementation evaluation data.

Reasons to Modify the Plan

Modification of the district plan can occur for many reasons. New and emerging technologies that can better address the instructional needs of the district may become available. Outside budget constraints could suddenly render parts of the plan unaffordable. New legislative mandates could be imposed upon a district or new instructional needs could be identified. But more likely, modification of the district plan will take place when the evaluation data indicate there is a need to redirect or alter a particular part of the plan or even the plan as a whole.

As pointed out in chapter 8, evaluation of the plan gives implementation teams periodic measurements of the establishment, operation, and effectiveness of the plan's elements. This assessment may indicate that certain parts of the plan were not thought through carefully or that some parts have not been implemented, perhaps because hardware has not been installed or timelines have not been met. The problem could be that teachers were having difficulty adapting the new technology, or technologies, to their teaching styles. Or maybe the students were not learning the instructional content as well as had been predicted during the planning stage.

Reconsideration and possible revision of the plan should occur annually to keep the implementation process on track—a track that is meant to be cost-efficient for the district and instructionally effective for students and staff. The annual review of the implementation plan should be coordinated by the steering committee. The evaluation checklist in appendix F can be used to match actual implementation outcomes with those anticipated in the plan.

Priorities for Change

An effort should also be made to establish priorities for change based on these comparisons. These priorities could address problems identified in the evaluation phase, such as changes in the facilities that house the technologies, hardware and software purchases, staff development and staff support programs, equity and access policies, budget cycles and levels, curriculum integration needs, and other concerns.

It is important to remember that it is not an easy task to modify a plan that is already partially or fully operational. Implementation of any major project will take a lot of time and cannot be done all at once. Modifications must not disrupt the ongoing implementation and must mesh with parts of the plan already in place. Also, the modifications must not interfere with parts of the plan that will be put into operation in later phases to meet timelines that have already been established.

Finally, the review should result in a revised implementation plan and schedule, with the steering committee having the responsibility for facilitating the recommended changes. The steering committee must also evaluate the impact of the revised implementation plan and modify the evaluation checklist to reflect new components of the plan. It is particularly important that the steering committee continue to communicate to students, staff, and the community the nature of any modifications being made. The steering committee must fully explain why the changes need to be made, the costs involved, and the expected impact they will have on the district.

Because change is always a difficult process to experience and manage, the steering committee should keep in mind these principles of managing change.

- It is easier to change things than people—schedules must be realistic.
- Those making the changes must have the courage of their convictions. This does not imply rigidity, because adaptability may be critical, but it does imply a clear sense of purpose.
- A sound base of objective data must be the foundation for initial planning. After these data have been taken into account, diversity of thought can be encouraged.
- The strong, early involvement of all those who will be key participants in effecting change must be sought. It is essential to secure the understanding and commitment of key participants, and to gain their insights.

- Potential roadblocks must be anticipated in order to minimize surprises.
- The human, financial, and physical resources required must be estimated, and planners must determine whether the cost is affordable.
- Effective channels of communication must be established.
- Timing can be critical. Planners should try to determine if there is a "natural" time to introduce the new telecommunications technologies into the curriculum.
- Change should be scheduled in measurable, comfortable stages. Trying to do too much too soon can be counterproductive. (Anderson, 1987, p. 64)

References

Anderson, M. Elaine. *A Guide to Curriculum Planning in Computer Education*. Madison: Wisconsin Department of Public Instruction, 1987, p. 64.

Appendixes

10

A. *Instructional Telecommunications and Other State and Regional Agencies*

B. *Online Services and Networks*

C. *Sources of Cable TV and Satellite Programming*

D. *Reaching and Teaching through Interactive Television*

E. *Instructional Telecommunications Technologies Assessment Instrument*

F. *Instructional Telecommunications Plan and Implementation Process Checklist*

G. *Glossary of Terms*

Instructional Telecommunications and Other State and Regional Agencies

Many state and regional agencies and councils provide leadership and coordination of instructional telecommunications activities in Wisconsin. This appendix briefly explains the roles they play in this area of education and how they work cooperatively to achieve their common goals. It also discusses some of the instructional telecommunications opportunities they make available to Wisconsin schools.

Department of Public Instruction

In the Department of Public Instruction (DPI) the Bureau for Instructional Media and Technology (BIMT) has primary responsibility for instructional telecommunications. The bureau represents the DPI on such groups as the Distance Education Technology Initiative Council (DETIC) of the Wisconsin Educational Communications Board (WECB). It also provides staff support for DPI and interagency telecommunications projects. A consultant in the BIMT helps state schools expand their effective use of instructional telecommunications in Wisconsin. This consultant works with directors of regional educational telecommunications areas (RETAs) and maintains a close relationship with WECB staff, the University of Wisconsin (UW) System Media Council, and the Wisconsin Technical College System (WTCS) Media Consortium. The instructional telecommunications consultant also helps cooperative educational service agencies (CESAs) and school districts plan their use of instructional technologies.

The BIMT lends staff support to the State Superintendent of Public Instruction's Council on Instructional Telecommunications (CIT). The superintendent appoints 15 council members—one from each of the 12 CESA areas, two from private education, and one from the group of RETA directors. Members are selected from a broad range of K-12 educators and include administrators, teachers, media directors, principals, and directors of instruction. In November 1987 the council began an examination of distance education in K-12 schools in Wisconsin. Its final report was titled *Distance Education for Elementary and Secondary Schools in Wisconsin*, and one of its recommendations stressed the need to ensure that K-12 schools in Wisconsin had universal access to distance education technologies.

DPI, in partnership with the WECB, is a member of the Satellite Educational Resources Consortium (SERC). This consortium of 24 states was formed in 1988. It pools the expertise and resources of state departments of education, state broadcast networks, local school districts, individual public broadcasting stations, and institutions of higher education. SERC offers live and interactive student courses, curriculum enrichment programs, professional development workshops, and graduate school credits for school personnel.

Wisconsin Educational Communications Board

The WECB makes policy decisions for state public radio and television stations. It also works with state schools to ensure that educational programs on public stations meet the interests and needs of all Wisconsin residents. The WECB also helps state educational institutions to cooperatively acquire, develop, and use instructional programs, technologies, and services. The 16 members of the WECB include the governor, four state legislators, and representatives of state, local, and private schools.

Wisconsin has a public television system that serves all parts of the state. Public television carries extensive educational programming during the school day, offering more than 125 instructional television (ITV) programs for K-12 students. There are also three major instructional series on Subsidiary Communications Authorization (SCA) radio, also known as the School Radio Service.

Public television also airs approximately 15 university and adult education courses each semester. The WECB and DPI offer student courses over the SERC network and produce K-12 professional development teleworkshops and graduate level courses for this satellite system. The WECB has coordinated the study and design of a proposed statewide telecommunications infrastructure and helped provide funding for various distance learning projects in Wisconsin.

Distance Education Technology Initiative Committee

The DETIC was originally formed to advise the WECB on the *Wisconsin Distance Education Technology Study*. This report was prepared for the board in 1993 by Evans Associates, a Madison, Wisconsin, consulting firm. DETIC's members represent the DPI, Department of Administration (DOA), WTCS, UW System and UW-Extension, private higher education, and CESA districts. DETIC also counsels the WECB regarding technology services the board provides to its various constituencies and on development of a distance education network for Wisconsin.

Department of Administration

The Wisconsin DOA and its Bureau for Technology and Management (BITM) have worked jointly with DETIC and other state groups to design a statewide telecommunications infrastructure for state agencies. This network will make it easier for state agencies to share electronic information, whether in the form of voice, video, or data. It will probably be transmitted on the existing State Telephone System (STS). BITM also cooperates on other state telecommunications projects.

ITFS User Groups

In order to be effective, Instructional Television Fixed Service (ITFS) programming must be carefully selected to meet the educational, inservice, and training needs of schools each ITFS system serves. The instructional material must also be transmitted at times when teachers, students, and others can receive it. The bodies that govern these decisions are the ITFS User Groups.

In 1994, there were approximately 20 ITFS systems operating in Wisconsin. Each system is shared by the school districts and UW System and WTCS campuses located in its signal area. ITFS systems also provide instructional programming to business constituents. User groups include representatives from every entity that employs the ITFS system to transmit or receive programming. The duties of the ITFS User Groups are to

- identify and assess the specific educational needs of every group they should serve;
- recommend suitable programming, identify program providers, and cooperate to secure and develop programming for ITFS;
- establish a program schedule for each channel; and
- help educate individual communities about the system's availability and potential.

User groups meet before the start of each semester to finalize programming schedules. Members consider requests for use of each ITFS channel and resolve program conflicts. User groups also make decisions about operational costs and purchases of live or taped programs.

Regional Educational Telecommunication Areas

RETAs are more formally known as regional service units (RSUs). RETAs help educators effectively use ITV and SCA programming as well as other distance learning resources. RETAs work with the WECB, the DPI telecommunications consultant, and local school districts on distance learning projects.

RETA staff cooperate with personnel from local school districts and provide monthly newsletters and workshops for teachers and administrators. In the workshops, school personnel learn how to integrate ITV series and other instructional telecommunications technologies into their curriculum. RETAs are funded through membership contracts with local school districts and nonpublic schools. RETA staff serve the state from six cooperative educational service agencies (CESAs). The CESA areas roughly cover the service areas of the state's public television stations.

Cooperative Educational Service Agencies. Through the years, CESAs have played a variety of roles in instructional telecommunications. They house the RETAs and act as their fiscal agents. Each CESA also coordinates instructional technology in its own area. Services that CESAs provide school districts include

- a regional library media center,
- a special education instructional media center,
- instructional use of computers,
- instructional television (through RETAs),
- a regional technology lab, and

- support for other emerging instructional technologies.

CESA Instructional Technology Services Council. One of the groups dealing with instructional telecommunications at the CESA level is the CESA Instructional Technology Services Council (CITSC). It helps CESAs plan, promote, and support use of instructional technologies in their service areas. CITSC members are the instructional technology service coordinators for each CESA. The council also facilitates interagency cooperation by CESAs on instructional telecommunications issues at the state level. The CITSC also helps sponsor and conduct statewide technology conferences, guides CESAs in purchasing videotapes and software, and develops statewide technology-related initiatives with the DPI and other state agencies and organizations.

State Board of the Wisconsin Technical College System

The WTCS has played an active role in expanding instructional telecommunications in Wisconsin. More than 6,000 students in Wisconsin have completed adult study courses that WTCS has delivered through various technologies. Members of the system's Media Consortium represent each of its 16 districts and meet regularly to plan for instructional telecommunications activities at various campuses.

WTCS Media Consortium

The Media Consortium gives WTCS campuses a forum to share information and expertise on instructional telecommunications technologies. It also facilitates cooperation among WTCS districts.

The consortium works with district and state office representatives to

- acquire commercially produced instruction,
- develop and/or produce media-based instructional materials and courses that meet common instructional needs,
- promote interdistrict sharing and use of media-based materials and alternative learning curriculum materials,
- cooperatively schedule and promote telecourses for the state educational television network and other statewide distribution systems,
- facilitate cooperation among districts in joint ventures to produce and/or receive satellite programming and conferences,
- identify additional areas of cooperation to increase the ability of the WTCS to offer expanded alternative learning opportunities,
- investigate and make recommendations on potential applications of new and developing communication technologies, equipment, and alternative delivery modes, and
- maintain ongoing WTCS communication and cooperation with the UW System, DPI, WECB, and other organizations on application of alternative learning systems.

WisConLink. WTCS is particularly active in satellite-delivered teleconferences. All 16 WTCS districts began installing satellite reception equipment in 1983, and satellite instruction has proven to be a valuable resource. The amount of programming available, its subject matter, and the number of producers have all increased tremendously since 1983. WisConLink is the outgrowth of the increase in such educational opportunities.

The WTCS Satellite Cooperative was formed in 1986 to coordinate consortial licensing of programs and to provide districts with complete and consistent information on this type of instruction. In 1989-90 the name of the organization was changed to WisConLink.

WisConLink keeps districts informed of satellite offerings through a monthly newsletter, program listings, and an electronic bulletin board. It also negotiates group pricing on site licenses, handles invoices and billings between districts and originators of programming, and serves as the liaison between districts and video conference producers and sponsors.

Wisconsin Foundation for the Wisconsin Technical College System. The Wisconsin Foundation for the WTCS is a private, nonprofit corporation established in 1977 to receive gifts, grants, and bequests on behalf of the system. The foundation's video division is involved in the acquisition, development, production, and distribution of video-based instructional materials. The video division's current projects include interactive videodisc basic math, algebra, and electronics.

University of Wisconsin System

The UW System has most likely been using instructional telecommunications technologies to reach students in Wisconsin longer than any other state educational institution. It started one of the first public radio stations in the nation and has conducted educational programs using it since the 1930s. The UW Board of Regents also holds the license for one of the state's public television stations. In addition, the UW System houses WiscNet, which provides access to Internet and its international, high-speed data and telecommunications services.

WiscNet. WiscNet, a nonprofit association created by the UW System, gives higher education institutions in Wisconsin access to national and international computer networks. It is a major gateway to Internet, the worldwide telecommunications network. The statewide network includes data communications circuits linking individual sites. It also has a management and support structure to ensure its continued operation and growth. WiscNet began operation in January 1991. For information on how this network relates to K-12 schools, call (608) 266-1965.

Educational Media Council. The roots of the UW System's Educational Media Council (EMC) can be traced to the Joint Staff Committee on Educational Television, created in 1961 by the Coordinating Committee on Higher Education (CCHE). In the 1960s, CCHE was responsible for merging the state's two postsecondary education systems into the current UW System. EMC members are chosen from the two public systems of higher education that operated prior to the merger. The council's purpose is to develop a coordinated state plan for educational television to enable Wisconsin to qualify for federal funds.

The EMC meets approximately four times a year. It considers a wide range of issues, including copyright legislation and its implications, music licensing, inservice training for staff members, computer-assisted instruction, state purchasing contracts, and relationships with the DOA.

Council members represent various disciplines and have experience in many areas, including radio and television production, writing grant proposals, cable television issues, and administering media systems. The council helps individual campuses secure grants for projects involving media and outreach, produce media software, and structure inservice training programs on instructional technologies. The EMC also offers members advice on technologies such as broadcast television, cable television, fiber optics, or ITFS.

University of Wisconsin-Extension

The UW-Extension provides university outreach. In the mid-1960s, at a time when such an idea was unique, the UW-Extension developed the Educational Teleconference Network (ETN), a teleconference system. The network and its companion service, WisLine, are used by many state educational institutions and a variety of state agencies.

The UW-Extension also created WisView, an audiographics instructional telecommunications system that combines audio teleconferencing with a computer-based display of charts, text, and color pictures. The extension also provides an electronic bulletin board service with discussion forums, information sets, and databases on a variety of topics, including a listing of activities in the state from WisCon-Link.

The Educational Teleconference Network (ETN) is a dedicated audio network. It is operated by the UW-Extension's Instructional Communications Systems (ICS) and links approximately 200 sites throughout the state, including UW System two- and four-year campuses, hospitals, and libraries. ETN each year offers more than 300 full-credit and continuing education courses. It also provides public service programs and allows its facilities to be used for teleconferences. For information call (608) 262-4342.

WisLine, the second teleconference system managed by ICS, can link one site with up to 67 other locations anywhere in the world. ETN is a fixed system connected by dedicated telephone lines, so only people who are at those sites can use it. WisLine, on the other hand, is a dial-up teleconference system available to any party with access to a telephone. Educational, governmental, and nonprofit groups use WisLine for meetings, credit and noncredit courses, news conferences, interviews, legal hearings, and other purposes. For information call (608) 262-4342.

WisView is an audiographics system managed by ICS and available to all UW System campuses that have audiographics equipment. Additional Wisconsin or out-of-state sites, whether in a school or another location, can be set up on a course-by-course basis. For information call (608) 262-4342.

Online Services and Networks

Computer telecommunications offer schools a wide range of educational opportunities. Students who use computers equipped with modems can exchange messages or information with "pen pals," experts, and celebrities around the world. Computers also help teachers stay in touch with each other, share information and experiences, conduct research in online databases, and download software. Online services can provide activities to enhance classroom instruction in a specific curriculum or subject area, or help students obtain information on topics of interest.

This list is selective and is not intended to be an exhaustive directory of online services for educators. The first part of this appendix deals with national online services and networks and the second part with those made available by state agencies. Telephone numbers listed in this appendix are for voice communications unless otherwise noted (in some cases the numbers are for direct computer access). Unless other specifications are given, the communications parameters for modem settings are 8 data bits, 1 stop bit, and no parity.

National Online Services and Networks

Of the services in this section, the following have active global classroom components: AT&T Learning Network; DataTimes; GEMNET; GTE Education Network; Interactive Communication Simulations (ICS); National Geographic Kids Network; Pals across the World; and XPRESS XChange.

Accu-Weather. Weather forecasts can be downloaded to a computer directly from Accu-Weather. The service provides access to meteorological, hydrological, and geophysical data from around the world. "Accu-Weather Forecaster" (for MS-DOS and Macintosh computers) and "Accu-Access" (for MS-DOS) are optional software packages that connect to the system and graphically display selected data in charts and maps. (814) 234-9601, ext. 400

ADVOCNET. Operated by the National Center for Research in Vocational Education in Berkeley, California, this electronic mail (e-mail) and information network is for educators in vocational and technical fields. (510) 642-4004

Ag Ed Network. Designed for teachers in general but with a focus on agriculture, this source contains 1,300 ready-to-use teaching units covering various areas of agribusiness. Topics include production, horticulture, biotechnology, marketing, and agriculture accounting. This network features nine state curricula, a weekly news summary with quizzes, and two-way e-mail. (414) 283-4454

ALANET. The American Library Association's e-mail network provides gateways to information services and resources for libraries, national e-mail services, and U.S. information providers. (800) 545-2433

America Online. Formerly known as **Applelink-The Personal Edition**, this service is designed for Apple II and Macintosh computers. The system is accessed with custom interface software and includes hardware and software libraries, news articles, financial information, and an online encyclopedia. Its Learning Center section offers databases and other resources that can be useful for educators. America Online also provides access to the Internet. (800) 827-6364

AT&T Learning Network enables schools around the country and globally to share information and collaborate on classroom projects via the AT&T Mail Network. AT&T Learning Network offers a structured approach to integrating telecommunications into the classroom. It provides a curriculum guide, communications software, and technical support. (800) 367-7225, ext. 4158

BRS. Like DIALOG, Bibliographic Retrieval Services (BRS) is one of the giants in the database industry. BRS provides access to hundreds of databases, many of them pertinent to the information needs of schools. (800) 955-0906 or (703) 442-0900

Classmate (part of **DIALOG**) introduces students from elementary school through graduate school to online information retrieval. Its simplified command language, or menu, provides access to 85 general interest databases on full-text news and magazine stories, general science, social studies, and the humanities. Curriculum materials include workbooks, teacher guides, transparencies, suggested readings, lecture notes, and a video. (800) 334-2564

Cleveland Free-Net is a free, open-access community computer system operated by Case Western Reserve University in Cleveland, Ohio. This bulletin board system (bbs) features free worldwide e-mail and offers information databases and forums on health, education, technology, government, arts, recreation, and law. The number for computer communications is (216) 368-3888.

CompuServe is a popular network covering nearly 500 topics and offering services such as e-mail, conferencing, computer forums, and games. It also serves as a gateway to other database systems such as DIALOG and BRS. CompuServe includes 20 sources of information relating to schools or education. (800) 848-8199

DataTimes is a full-text database of local, regional, national, and international newspapers and news sources. It also provides a gateway to the Dow Jones News/Retrieval service. Reduced rates for schools are available. (405) 751-6400

Delphi. An affordable information service, Delphi has many of the same features as CompuServe, including e-mail, conferencing, shopping, special interest groups, news, games, an encyclopedia, and gateway access to DIALOG. (800) 544-4005

DIALOG. A leading database provider in the online information industry DIALOG has more than 400 databases, including several dozen of specific interest to schools. DIALOG also provides access to a subset of its offerings through Classmate, a service discussed previously in this section that is available to schools at reduced rates. (800) 334-2564

ED Board. The U.S. Department of Education uses ED Board to provide grant and contract information to the public. Registration is not required and the only charges are for telephone calls. The computer number is (202) 260-9950 (set modem at 8,1,N), or more information can be obtained by calling (202) 708-7811 (voice).

EdLINC is a free online service for professionals in resource, media, information, library, and service centers. It includes a database of current information on instructional materials and school products. (614) 793-0021

EquityNet. Developed by the Programs for Educational Opportunity at the University of Michigan, EquityNet provides access to a range of up-to-date information about equity and education. It focuses on teaching students of different races, genders, and national origins. (313) 763-9910

FrEdMail Network. This is a network of electronic bulletin board systems (bbs) from more than 60 schools across the nation that are used for a variety of purposes, including teacher forums, student activities, and collaborative projects. "Kids 2 Kids" is a popular writing project. FrEdMail bulletin boards are a good way to communicate with other schools around the country and the world. More information or the software needed to set up a FrEdMail system is available from Computer-Using Educators, P.O. Box 2087, Menlo Park, CA 94026; (619) 475-4852.

GEMNET. Coordinated by Global Education Motivators, Inc., GEMNET is a computer communication and information network that provides e-mail and databases for worldwide communication. Some of its features are United Nations information, including news releases, resolutions, speeches, and issue summaries; a "World Countries Database"; and e-mail and videocassette exchanges among schools around the world. (215) 248-1150

GEnie. General Electric's low-cost alternative to CompuServe has a wide selection of services, including an online encyclopedia, news from 11 news agencies, games, *USA Today* online, and an education roundtable. (800) 638-9636

Global Lab provides international, environmentally based projects to improve science education in several countries. The lab runs on the EcoNet network. There are sign-up costs, monthly fees, and hourly telephone charges. (617) 547-0430

GTE Education Network. GTE offers information services and online activities to educators. Included are databases for education information, SpecialNet (described below), Youth News Service, CNN Newsroom, and e-mail. (800) 927-3000

Interactive Communication Simulations (ICS) enables students in the United States and throughout the world to use computer conferencing in a variety of instructional exercises. Topics include a role-playing simulation of the "Arab-Israeli Conflict" and an interdisciplinary exercise called "Earth Odyssey." (313) 763-6716

Lab Net is a network funded by the National Science Foundation to enhance science teaching. It promotes interaction and support for experimental, collaborative, and project-based instruction. Lab Net services include e-mail, a bbs, conferencing, and online databases. It also provides access to working scientists. (617) 547-0430

LEXIS/NEXIS. Although targeted mainly for law offices and law schools, this service is one of the best available sources of full-text legal information. NEXIS contains hundreds of newspapers, magazines, and other information databases in full-text format. (800) 227-4908

MacNet and PC/MacNet are offered by Connect Inc., an information network that provides user forums (including several for educators), software libraries, e-mail, newswire services, stock quotations, and other features. MacNet serves Macintosh systems, while PC/MacNet is for MS-DOS computers. (800) 262-2638

MCI Mail is one of the world's largest e-mail services. (800) 444-6245.

NASA Spacelink is an informational service for students and teachers from the Educational Affairs Department of the National Aeronautics and Space Administration (NASA). It provides NASA news, shuttle flight activities, workshops, listings of educational programs, classroom materials (including lesson plans, graphics, and computer programs), and many other services. It is free except for telephone charges. The number for computer communications is (205) 895-0028

National Distance Learning Center Database System is a free electronic information source listing nationally available distance learning courses, materials, curriculum guides, and teacher and school staff inservice training materials. It covers K-12, adult, and higher education offerings. This service is also a source of information and material on federal education programs. A comprehensive user guide can be obtained by calling (502) 686-4556.

National Education Association. NEA operates a computer conference on America Online, but its e-mail and information services are reserved for NEA members. The NEA Educational Issues Database is a source of information on selected education topics. A free software package for NEA members can be obtained by calling (800) 827-6364.

National Geographic Kids Network offers telecommunications-based science curriculum for grades 4 through 6 that enables students to conduct science experiments and to transmit results to the National Geographic Society. Data is pooled and analyzed by National Geographic scientists and the results are returned to participants. Schools on the network can communicate with other schools nationally and globally. Sample units include experiments on acid rain, weather, and water quality. (800) 368-2728

NewsNet provides access to the full text of specialized newsletters in a variety of fields, including education, electronics, and computers. It also features news from the United Press International wire service. NewsNet's Academic Instruction Program offers schools access at very low rates. (800) 952-0122

OERI PC Board. The U.S. Education Department's Office of Education Research and Information has a toll-free, 24-hour bulletin board with statistical and demographic information related to education. It also provides e-mail, file transfer, a bbs, and topic forums. The number for computer communications is (202) 219-2053.

Pals across the World is an international writing program linking more than 400 schools in over 15 countries. The program makes it possible for students to exchange questions, answers, research, and creative writing with "sister schools" around the world. Its headquarters is in Sydney, Australia. +61-2-451-9022

Prodigy. A consumer-oriented information service marketed by IBM and Sears, Roebuck and Co., Prodigy provides news, access to experts, data on health and finances, and many other features. Prodigy uses graphics more extensively than most other information services. Originally for MS-DOS compatible computer and software, Prodigy now has software for Macintosh computers. (800) 776-3449

SATLINK Online. This bbs was developed by the Education Satellite Network (ESN) as a service of the Missouri School Boards Association. It provides access to information regarding satellite-delivered programs and teleconferences currently listed in *Education SATLINK*, which is ESN's monthly magazine and satellite program guide. (800) 243-3376

SciBoard is a free bulletin board operated by the University of Louisville, Kentucky. Available to teachers, students, and the general public, it encourages participation in science and educational activities. (502) 852-0864

SciLink. An international electronic conference network, SciLink is designed specifically for members of the scientific and educational communities. Activities include joint curriculum exchanges, development and delivery of distance education, joint research projects, custom-designed conferencing, and special projects. (416) 922-7001

SpecialNet. GTE, in addition to its Education Network, also offers SpecialNet, an information service established specifically for special education professionals. It includes e-mail services and access to dozens of informational bulletin boards concerning special education. (800) 927-3000

T.I.M.E. (Technology in Migrant Education) is a bulletin board in Little Rock, Arkansas, that supports the use of computers and computer telecommunications in migrant programs. (800) 643-8258

The Weather Machine is another telecommunications-based instructional program from the National Geographic Society. To obtain current weather data, schools need to purchase *The Weather Machine* software (for Apple IIe or IIgs computers) as well as to subscribe to this online service. The software analyzes the information and creates color graphic presentations. (800) 368-2728

The WELL (Whole Earth Lectronic Link). This service is from the publishers of *The Whole Earth Catalog*. The WELL is a communications network that provides conversational forums and information on lifestyles, environmental issues, technology, and other topics. (415) 332-4335

WHA Infotext is an easy-to-use, menu-driven information service produced by the UW Cooperative Extension in Madison, Wisconsin. Among subject areas covered are "Home and Garden," "Commodity Markets," and the "National Weather Service." Weekly Wisconsin Public Television listings also are included. If no other bulletin board services are available, WHA Infotext is a good way to introduce students to computer telecommunications. The service is free except for long-distance telephone charges outside the Madison area. The number for computer communications is (608) 263-2420.

Wilsonline. *The Readers Guide to Periodical Literature* and more than a dozen other online databases are available from H.W. Wilson, a publisher of indexes for libraries. Reduced rates are offered to schools. (800) 367-6770, ext. 2253

WInet. This is the Wisconsin component of PSInet, a national bulletin board for math and science educators. Participants can access databases on state and national curricula, calendars, projects, and organizations; conduct discussions with cohorts on topical forums; access federal projects and personnel; and involve students in relevant projects. (608) 266-3319

The Internet

The Internet is a telecommunications network developed in the late 1960s by the U.S. Defense Department. It was designed to facilitate quick transmission of data among researchers in defense-related projects and to test fault-tolerant communications systems capable of surviving a nuclear attack. The Internet has expanded far beyond its original focus and today connects more than 12 million users through 12,349 separate networks in 56 countries. It operates on all continents, and there are even two Internet sites at research stations in Antarctica. It is estimated that half of the 3,600 colleges and universities in the U.S. are linked to this network.

The Internet provides a wide variety of services. Among the most popular are

- an e-mail system,
- hundreds of electronic discussion groups,
- electronic files of information on a wide variety of subjects, and
- a database of more than 350 library catalogs.

The electronic discussion groups, often called "discussion lists," are on topics ranging from acupuncture to zymurgy (home brewing). Among other Internet resources are many subject-related information files and databases, including federal publishing office documents. With network access, much of this information is available at no additional cost.

WiscNet, a nonprofit state association discussed later in this appendix, provides Wisconsin institutions of higher education a gateway to the Internet. Kindergarten through twelfth-grade (K-12) schools can access WiscNet through a member institution, but fees are often involved. Those interested should call the nearest University of Wisconsin System campus or a private college for information on how to use WiscNet to access the Internet.

The following list provides information on how to access different files in the Internet system for use in prekindergarten through twelfth-grade classrooms. It was compiled by Judi Harris, professor of curriculum and instruction at the University of Texas at Austin. The list also is available on the Internet.

Name: AskERIC
Address: ericir.syr.edu
Subdirectory path:
pub/Q&A
pub/miniSearches
pub/Digests_HelpSheets
pub/LM_NET
Description: Archive of ERIC resources, including frequently asked questions, Silver Plater searches on selected topics, selected ERIC digests and help sheets, and archives of the LM_NET LISTSERV discussion list.

Name: EdNET Archive
Address: nic.umass.edu
Subdirectory path: pub/ednet
Description: Files that list LISTSERVs and Usenet news groups that relate to education (educatrs.lst and edusenet.gde).

Name: Garbo Archive
Address: garbo.uwasa.fi
Subdirectory path:
mac (*for Macintosh software*)
pc (*for MS-DOS software*)
windows (*for MS-DOS machines with windows*)
Description: Contains shareware software for Macintosh and MS-DOS machines.

Name: History Archive
Address: ra.msstate.edu
Subdirectory path: pub/docs.history
Description: Contains documents that pertain to the study of history and other online history databases.

Name: JPL Education Archive
Address: pubinfo.jpl.nasa.gov
Subdirectory path: pub
Description: Contains archives of NASA educational materials, outer space, .gif (graphic image format) images, the *Universe* newsletter, and space mission fact sheets.

Name: NASA Archive
Address: ames.are.nans.gov
Subdirectory path: pub/SPACE
Description: Archives of NASA's Ames Laboratory with information and files on the space program. Also contains a large file of .gif pictures from the Voyager mission as well as the space shuttle. Software for viewing the pictures is also available for many types of desktop computers.

Name: KYBER-12 Archive
Address: byrd.mu.wvnet.edu
Subdirectory path: pub/estepp/kyber-12
Description: Archive of K-12 resources; retrieve the file project.kyber-12 for a full description of the online project.

Name: Logo Archive
Address: cherupakha.media.mit.edu
Subdirectory path: pub
Description: Contains archive of public-domain Logo software, discussions, newsletters, sample programs, and so on.

Name: NCSA Archive
Address: ftp.ncsa.uiuc.edu
Subdirectory path:
education/education_resources
Description: Contains documents pertaining to the educational use of telecomputing tools, including Mosaic, Mosaic tool programs, and sample Mosaic pages.

Name: Project Gutenberg
Address: mrcnext.cso.uiuc.edu
Subdirectory path: etext
Description: Project Gutenberg is an organization with the goal of preparing electronic editions of more than 10,000 books by the year 2001. All documents are available as text-only files, but many can be obtained in PostScript format. Contains children's books, historical documents, religious texts, and poetry.

Name: Science Education Archive
Address:
ftp.bio.indiana.edu
129.79.224.25
Description: Contains files intended to assist science teachers.

Name: "Teacher Contact" Lists
Address: ftp.vt.edu
Subdirectory path: pub/k12
Description: Contains periodically updated lists of K-12 teachers with Internet access.

Name:
Texas Center for Educational Technology
Address: tcet.unt.ed
Subdirectory path: pub/telecomputing-info
Description: Contains documents and .gif pictures pertaining to the use of Internet-based tools in K-12 education.

Name: Washington U. Public Domain Archives
Address: wuarchive.wustl.edu
Description: Contains a large collection of freeware and shareware for many types of computers. Choose subdirectories according to the type of software desired.

Name:
Consortium for School Networking (CoSN)
E-mail address: info@cosn.org
Description: CoSN is a membership organization formed to further development of, promote access to, and encourage use of telecommunications in K-12 education.

Name: Internic Information Services (IIS)
E-mail address: info.internic.net
Description: IIS collects, maintains, and distributes information about the Internet and provides assistance to networking end users. An *Internet Resource Guide* and other resources can be obtained by sending e-mail to info@internic.net and typing in the body of the message: Request: info, Topic: help.

Name: Electronic Frontier Foundation (EFF)
E-mail address: eff@eff.org
Description: EFF is a membership organization focusing on policy issues related to national networking. In the K-12 context, EFF concerns itself with policies for determining the resources to which students will have electronic access.

Name:
International Society for Technology in Education (ISTE)
E-mail address: iste@uoregon.edu
Description: ISTE is an organization serving computer-using educators and is dedicated to the improvement of education through the use and integration of technology. A special interest group for telecommunications (SIG/Tel) can be joined by sending e-mail to schrumlm@splava.cc.plattsburgh.edu.

Name:
Technical Education Research Centers (TERC)
E-mail address: ken_mayer@terc.edu
Description: TERC researches, develops, and disseminates innovative programs for educators, with a special interest in curriculum projects involving telecomputing.

Name: Center for Children and Technology
E-mail address: mhoney@.edu.org
Description: The center investigates the roles of technology in children's lives, both in the classroom and in general, and the design and development of prototypical software that supports engaged, active learning.

Name: The Best of K-12
Address: tiesnet.ties.k12.mn.us
Subdirectory path:
best of K-12 internet resources
Description: This gopher contains a large selection of educational resources for grades K-12, including news, guides, books, exchange information, and access to gophers and a bbs.

Name: Lesson Plans
Address: copernicus.bbn.com
Subdirectory path:
National School Network Testbed/Lesson Plans from UCSD
Description: This gopher contains sample school lesson plans that can be searched and viewed and is being used to test ways to make a database of lesson plans available electronically.

Name: NYSERNet
Address: nysernet.org
Description: This gopher is provided by the New York State educational network and offers Internet-related resources to K-12 teachers wishing to use telecomputing tools for professional development and instruction.

Name: Reading Room
Address: info.umd.edu
Subdirectory path:
educational resources/the reading room
Description: This gopher contains a large collection of journals, newsletters, and texts as well as access to other subject-related gophers at the University of Maryland.

Name: SchoolNet
Address: ernest.ccs.carlton.ca
Description: An educational networking initiative of Canada, this gopher provides educational information, discussions areas, and learning tools to schools in Canada.

Name: U.S. National K-12 Gopher
Address: copernicus.bbn.com
Description: This gopher is a national research and development resource in which schools, school districts, and community organizations can experiment with applications that bring significant new educational benefits to teachers and students.

Wisconsin State Agency Services and Networks

Wisconsin educators also have access to several electronic bulletin boards and one computer network operated by various state agencies.

WiseNet is a bulletin board service of the Department of Public Instruction (DPI). DPI provides a toll-free telephone number for access to DPI news bulletins and releases, a DPI staff directory, and a calendar of statewide educational events. WiseNet also offers education news from national and state sources, alcohol and other drug abuse (AODA) and Wisconsin Clearinghouse information, special interest group bulletin boards, CESA meeting agendas and minutes, shareware programs, e-mail, and DPI reports and statistics.

School districts can use WiseNet to transmit annual reports and other data to the DPI or to import documents, reports, and DPI-developed computer files from the DPI. This bulletin board is free. Those wishing more information may call (608) 266-2529 or (608) 266-2022. The telephone number for computer contact is (800) 322-9374.

Learning Link Wisconsin is a bulletin board service operated by the Wisconsin Educational Communications Board (WECB). There are no charges, but each online session is limited to 15 minutes. An "800" number covers long-distance telephone costs. A personal log-on code and password is needed to access Learning Link.

Many services are available for K-12 teachers. For instance, teachers who use the "What's in the News" series on public television can obtain advance program information and a teacher guide. Teachers can also get the *Daily Classroom Guide* for "CNN Newsroom," a 15-minute news program geared for students in grades 7 through 12. This commercial-free program is telecast daily on the CNN network and can be videotaped. Teacher guides for these two current events programs can be downloaded onto disk or printed out.

Learning Link also features "Curriculum Connection," a database containing descriptions of instructional programming broadcast by the WECB on Wisconsin Public Television. Subscribers can search the database to locate programs to augment classroom instruction. Other Learning Link features include e-mail, a group of subscriber "Forums" with information on professional development opportunities, updates and changes in Wisconsin Public Television programming schedules, and discussion centers for exchanges of ideas on specific education topics or issues. More information can be obtained by calling (608) 264-9688.

UW-Extension Bulletin Board is a bulletin board service linking educators at county UW-Extension offices, UW System and WTCS campuses, and K-12 school districts. UW-Extension staff in the Instructional Communications Systems (ICS) and WISPLAN computing services jointly operate this service.

This bulletin board offers program data on live and taped satellite video conferences from around the nation, e-mail services, Wisconsin satellite downlink site data, UW-Extension system news, and a subscriber discussion section called NOTES that has open discussion and bulletin areas. It also has one of the most comprehensive reports on national and state satellite video conference providers and networks. The list indicates if conferences are live or taped, if they are new, and what Wisconsin sites host the programs. Subscribers also receive a mailing list and a video conferencing news discussion. (608) 263-4342

WiscNet is a nonprofit association. It was created primarily to provide higher education institutions in Wisconsin with access to national data network resources. It also makes possible data communications between higher education institutions. One of its key services is providing access to the Internet.

WiscNet was formed in 1989 with the expectation of developing a National Science Foundation proposal for a statewide higher education network in Wisconsin. Charter members include all UW campuses and eight private colleges and universities. The WiscNet board is trying to extend membership beyond institutions of higher education. For more information, schools should contact the nearest UW System campus or call (608) 266-1965.

Sources of Cable TV and Satellite Programming

Cable Television Providers

Cable television carries a great deal of programming that can be used for educational purposes with elementary and secondary students. Today, in fact, cable television companies are becoming active in providing educational services to kindergarten through twelfth-grade (K-12) schools. Cable in the Classroom is the industry's public service initiative to enrich education through commercial-free cable programming. Its members are major cable companies and national cable programmers. They share the following goals:

- increasing awareness of the wide range of high-quality cable television educational programs available without commercial interruption;
- providing curriculum-related support materials, extending copyright clearances so programs can be replayed on videotape, and helping teachers use cable programs in the classroom; and
- contributing free installation and free basic cable service to public and state-approved private and parochial junior and senior high schools.

Cable in the Classroom members each month air approximately 500 hours of commercial-free programming. Local cable companies work with schools through workshops and support material to encourage effective use of these shows in the classroom. More information is available from the Educator Hotline at (800) 743-5355. Or school personnel can write Cable in the Classroom, 1900 North Beauregard, Suite 108, Alexandria, VA 22311.

Cable Channels

Following are some of the cable channels that offer programming suitable for education. This list, however, is not a definitive compilation of every channel or show that might be appropriate for classroom use.

A&E Classroom airs a one-hour program daily featuring dramas, documentaries, and the performing arts. Shows are aimed at elementary and secondary students. Each fall and spring educators can request "A&E Classroom" material kits, which include five months of scheduling information, program descriptions, and study guides featuring student activities for selected programs. This channel also sponsors the A&E National Teacher Grant Competition, in which teachers create innovative projects based on A&E programs. (212) 661-4500

Black Entertainment Television (BET) produces "Teen Summit," a weekly show designed to enhance classroom learning and broaden student horizons. BET supports a national teacher recognition program and student achievement competition. It offers a magazine called *YSB* that provides support materials on teen issues. (800) 229-2388

CNN "Newsroom" is a 15-minute news program produced daily and shown every morning for schools to view or tape. Each program reviews the day's top news and human interest stories. A second in-depth segment focuses on specific topics, such as a global issue, international event, or scientific achievement. A teacher's guide on how to use the material, as well as additional news and information, is available via computer from XPRESS XChange, described under "Cable Information Service" in this appendix. Computers equipped with special modems can receive data on the same signal that delivers cable television. (800) 344-6219

Consumer News and Business Channel includes extensive market coverage, business news, and talk shows. Support materials, videos, and a glossary are available upon request. (201) 585-6469

C-SPAN provides "gavel-to-gavel" coverage of United States House of Representatives and Senate floor activities, including news conferences. It also features international legislative and public policy events. Live call-in programs are shown weekdays. C-SPAN in the Classroom, the network's educational service, provides teaching guides, lesson plans, access to the Purdue Archives of C-SPAN programs on tape, and monthly newsletters free of charge to teachers. All C-SPAN programs are cleared for classroom viewing under copyright laws. Taped programs may be retained in perpetuity for future use. (800) 523-7586

The Discovery Channel runs a daily, hour-long program appropriate for education. Each "Assignment Discovery" show focuses on two subjects in areas such as science, technology, the arts, and contemporary social issues. There are vocabulary words and study questions at the start of each program, with answers and suggested reading at the conclusion. The *Discovery Network Educator Guide* is available free of charge. It includes reproducible schedules and program descriptions for "Assignment Discovery," as well as a range of educational programs and products from Discovery Network. (800) 321-1832

ESPN airs "Scholastic Sports America," a weekly program devoted to achievements by high school athletes both on and off the field. ESPN's "Sports World" curriculum includes a teacher's guide and wall map, and its programs explore different cultures by focusing on sports in other countries. (203) 585-2000

The Family Channel presents two series aimed at K-12 students. "Zorrow" creatively motivates students to become educated like Zorrow, the show's main character. "Big Brother Jake" sets the stage for learning excursions on topics like self-esteem, the theater, and the Great Depression. Print materials are available at a nominal fee. (804) 523-7301

The Learning Channel presents "TLC Elementary School" every Tuesday. This commercial-free, closed-captioned program consists of several five- to 15-minute curriculum-based segments for K-6 educators. "Teacher TV" is aired on Sunday and features innovative teachers and other personnel in schools and communities across the nation. This program is coproduced by TLC and the National Education Association. The *Discovery Network Educator Guide* describes all programs and products available from TLC and is free to educators. (800) 321-1832

Lifetime television channel airs entertainment and informational programming for women and families. Hour-long, closed-captioned documentaries on issues that concern these audiences run the first Wednesday of each month. They are designed to help raise awareness and educate people about a variety of family concerns. Printed support materials and suggested discussion ideas are provided free to educators. (718) 482-4125

Mind Extension University (ME/U) is affiliated with more than 25 leading distance education providers. It features interactive instruction for elementary and high school students, undergraduate and graduate courses, and professional development and personal enrichment programs. Special K-12 programming includes the "Global Library Project," "Germany Lives," and "Career Encounters." A family programming guide is available. (800) 777-6463

Nickelodeon produces some educational and entertainment programs for children ages two to 15. This channel airs the "Lunch Box" series every Friday and "Nick News W/5" every Monday through Thursday. A brochure titled "Nickelodeon Goes to School" has program descriptions, schedules, and support activities. It is available free of charge. (212) 258-8000

Showtime offers commercial-free family programming during the day. "Chris Cross" and "Ready or Not" are two series for "tweens," those students from eight through 14 years of age. Printed materials include viewing tips. Suggested reading lists compiled by the Library of Congress are available upon request. (212) 708-1590

The Weather Channel airs "The Weather Classroom" every weekday. Each copyright-cleared, 10-minute program features a daily meteorology topic, information on current weather conditions, and a forecast. An illustrated textbook/workbook titled *The Weather Classroom* and severe weather preparedness handouts and videos are available at no cost. (404) 801-2503

Program Guides

Each of the cable television program providers described in this appendix has guides that help teachers use the material and explain where to find additional classroom readings and resources. Districts or schools should call their local cable television companies concerning the availability of these channels, programs, and materials.

In addition to specific program guides, there are several other print sources of information on satellite and cable television educational programming. Here are two of them.

- *Cable in the Classroom* magazine has information on selected cable, broadcast, and public television programming arranged by subject matter. It includes study guides for programs of interest, how-to features that demystify teaching technology, discussions of ways to use programs to strengthen curriculum, and directories of free teaching materials. This magazine can be ordered from local cable TV operators. Written inquiries may be sent to: Cable in the Classroom, P. O. Box 802, Peterborough, NH 03458-9971.
- *The Educator's Guide to Cable Television* provides tips on how to use programs in the classroom, reviews programs by subject matter, and runs weekly program listings. Subscription information can be obtained by calling (201) 941-6900.

Cable Information Service

The cable television industry can transmit data to computers on the same coaxial cable it uses to send television signals. However, a computer with a special modem is required to receive this data. XPRESS XChange employs this technique to transmit data and is available from participating cable television distributors. This service features information from over 20 sources and includes wire service news, stock market reports, and Notimex, a news service in Spanish. It also has conferencing features that put students in touch with other users and each day runs educational video highlights and CNN "Newsroom" support materials.

XPRESS XChange uses communications satellites, computers, cable television lines, and a special computer protocol to deliver high speed data to classroom computers. This service works on many types of computers including Apples, Macintosh, Atari, Amiga, and IBM. There are some setup costs associated with this service. (800) 772-6397

Satellite Programming Providers

A school with a satellite dish can receive instruction for high school students, graduate courses for staff, and enrichment programs that are not generally available on cable television. A satellite also can offer access to new teleconferences and staff development and inservice programs. These resources provide information about educational and general programming available over satellites.

- *Education SATLINK* is a monthly publication with program descriptions and air dates and times for shows created by the Education Satellite Network and other producers. Listings include the program title, producer, length, copyright description, and air times in all four time zones. The magazine also has articles on using satellite programs in the classroom, copyright issues, operating Ku-band satellite dishes, and maintaining satellite equipment. Call (800) 243-3376 for subscription information.
- *Satellite Learning* offers descriptions of satellite networks and chronological program listings of teleconferences and short program series. It separates credit courses and enrichment and inservice programs by program provider and network. Included are university, business, and governmental satellite program providers. Subscription information can be obtained by calling (409) 925-3900.
- *Satellite Scholar* is a monthly guide to satellite educational broadcasts that is categorized by discipline and grade level. Subjects include computer science, educational methodology, history, mathematics, physics, social studies, home economics, and many foreign languages. These courses are for students from kindergarten through graduate college, including continuing education for teachers. (800) 488-7882
- *Via Satellite* is published by Phillips Magazines, 7811 Montrose Road, Potomac, MD 20854. Information about *Satellite TV Week* can be obtained by calling ((800) 345-8876). Both magazines are sources of satellite program information. They can be purchased in stores or through subscriptions.

Descriptions of satellite providers follow. They are categorized by the type of instruction offered—high school courses, enrichment courses, and staff development.

High School Courses

Arts and Science Teleconferencing Service (ASTS) is operated by Oklahoma State University and specializes in advanced placement (AP) courses with a team teaching approach to education. The distance teacher is a university professor and the classroom instructor is a local partner. Among courses taught are German I, II, and III; AP Physics; and AP Calculus. Additional programs for the Scholastic Aptitude Test (SAT) and American College Test (ACT) are offered each semester. (800) 440-4332

Central Education Telecommunications Consortium (CETC) is one of the recipients of a grant through the U. S. Department of Education's Star Schools Program. CETC offers mathematics, science, and foreign language courses in 12 states, the District of Columbia, and the Virgin Islands. It is associated with the Black College Satellite Network in Washington, DC. (703) 979-8686

Mind Extension University, already mentioned under "Cable Television Providers" in this appendix, offers TI-IN courses for high school credit. (800) 777-6463

Satellite Educational Resources Consortium (SERC) includes 24 states—Wisconsin is a member—and provides courses in mathematics, science, and foreign languages. A Ku-band satellite dish is needed to receive programs. Courses offered are Japanese I and II, Russian I and II, Latin I and II, German I, Spanish III, Probability and Statistics, Discrete Math, Precalculus and Calculus, AP Micro- and Macroeconomics, Physics, Honors World Geography (which is team taught with the local classroom teacher), and Integrated Science 6, 7, and 8 for middle schools. More information is available from SERC at (800) 476-5001 or from the Wisconsin Department of Public Instruction at (608) 266-1965.

STEP Star from Spokane, Washington, offers courses titled Russian I and II, Japanese I and II, Advanced Senior English, AP Calculus, Spanish I and II, Career Paths, MS Science and Technology, Contemporary Applied Math, and Principles of Technology. A college credit option is available for these courses. (509) 536-0141

Telecommunications Education for Advanced Mathematics and Science (TEAMS) is based in the Los Angeles County Office of Education. It delivers science, technology, and multicultural mathematics courses to four large metropolitan school districts nationally. (310) 922-6635

TI-IN, a private vendor of high school credit courses, provides approximately 22 advanced high schools courses. TI-IN courses are received on Ku-band satellite dishes and on cable television over Mind Extension University. Languages taught are Spanish, French, German, Russian, and Latin. Other subjects offered are astronomy, psychology, sociology, and anatomy and physiology. (800) 999-8446

In addition, these two major providers extensively use data transmission and computers to augment their satellite programming.

IDEANet is an alliance of four distance learning providers that combines satellite and computer technologies to offer high school courses and professional staff development programs to school districts throughout the nation. Its members are the Missouri School Boards Association, Northern Arizona University, Oklahoma State University, and STEP Star. Four channels deliver live, interactive student courses, while another runs staff development programs. Additional services from IDEANet are a toll-free homework hotline, access to the Internet, SATLINK Online, CNN "Newsroom," and Post-Link, the daily online newspaper published by the *St. Louis Post-Dispatch.* (800) 440-4332

Depth of Choice is an alliance of several multistate distance learning providers that market their programs under one license. They offer approximately 5,500 hours of instructional resources, including satellite-delivered courses and programs. Depth of Choice incorporates data transmissions between teachers and participants into the instruction. Special events, adult education, staff development, credit courses, electronic field trips, and special subject-area modules and series are all offered. More information is available from Distance Learning Associates at (800) 786-6614 or (800) 735-9197.

Enrichment Courses

AG*SAT is a consortium of 33 land grant universities. They use satellite and other communications technologies to distribute and share academic instruction, cooperative extension programming, and agricultural research information. (402) 472-7000

Classroom Earth is a national organization of schools and educational facilities offering enrichment programs from many sources, including Oklahoma State University and NASA. This group also produces special-event teleconferences covering specific topics such as the Soviet and American space programs. For example, a program on joint space ventures featured American and Soviet crew members of the Apollo-Soyuz mission and was moderated by a panel of Soviet and American students representing grades 4 through 12. Classroom Earth's *School Satellite Guide* can be obtained from Bossier Parish Community College, 2719 Airline Drive North, Bossier City, LA 71111.

Reach for the Stars is a Star Schools grant recipient at the Massachusetts Corporation for Educational Telecommunications (MCET) in Cambridge, Massachusetts. It provides hands-on science material integrated with other areas of education to participants in seven states. This project delivers the educational materials via satellite, cable and broadcast television, teleconferencing, videodiscs, and computer-based programs. (617) 621-0290

SCISTAR offers programs that feature major scientists who discuss their work in paleontology, archeology, superconductivity, space medicine, and other subjects. (203) 677-8571

SCOLA runs seven hours each day of native language newscasts from more than 15 foreign countries. These programs enable high school foreign language students to hear a language spoken by native speakers. They also provide cultural awareness and enrichment, because the newscasts are rarely more than a day or two old. (712) 566-2202

Staff Development

In addition to the sources listed here, CETC, MEU, and the TEAMS systems also offer staff development programs. See the section on high school credit courses for descriptive and contact information on those projects.

The Missouri Educational Satellite Network (ESN), associated with the Missouri School Boards Association, provides classroom enrichment, staff development, and inservice training to more than 400 member schools. (314) 445-9920

SERC produces approximately 100 hours per year of subject-specific programs, including graduate-level courses for teachers. Staff development programs are structured in three two-hour telecasts that qualify for continuing education units in most states. SERC has telecast workshops on underachievement and a series of science and technology workshops for teachers of grades 8 through 12. There have been programs concerning development in early childhood, the mathematics curriculum, cooperative learning, parent and community communication skills, computer technology, and technology education. Information can be obtained by calling SERC at (800) 476-5001 or the DPI at (608) 266-1965.

STEP Star each school year offers about 140 hours of staff development programs on how to teach elementary science, communications skills for the 21st century, integrated models of instruction, creating productive classrooms, and other topics. Most are single-event teleconferences. (509) 536-0141

TI-IN produces approximately 400 hours of staff development and inservice programs on a variety of topics during each school year. It has run programs on supporting beginning teachers and teaching foreign languages in elementary schools. It also aired a career enrichment program on careers in biology, chemistry, earth science, physics, engineering, and mathematics. (800) 999-8446

Reaching and Teaching through Interactive Television

Material in this appendix was adapted from ideas presented at a workshop held at the Seventh Annual Conference on Distance Teaching and Learning in Madison, Wisconsin, in 1991. Presenters were Barbara Cummings, associate dean for alternative education at Northcentral Technical College, Wausau, Wisconsin; Helen Lacy, program director for Utah Public Television, Salt Lake City; and M. Winston Egan, professor of special education at Brigham Young University, Salt Lake City, Utah.

The purpose of this appendix is to introduce and explain adaptations required to effectively "reach and teach" through television. The suggestions and tips presented here also can be applied to delivering instruction over other instructional telecommunications technologies.

Teaching strategies outlined are designed to help educators differentiate between effective and ineffective instructional approaches to distance teaching. The suggestions provided also may help them learn how to identify at least five effective behaviors to reach and teach through television or another instructional telecommunications technology.

Planning, Teaching, and Interacting (Reaching)

Planning

- Outline the course into sections that correspond to each class session.
- Determine the objectives to pursue in each class session; do not try to cover everything in one class.
- Think about different ways of achieving each of the classroom objectives by
  - — determining what concepts are truly difficult for students to understand,
  - — selecting technologies that may be effectively used, and
  - — determining the interactivity that will make the concepts being taught meaningful.
- Think about how to address the following elements.
  - — Clarity/organization
  - — Pacing
  - — Media (or other distance learning technologies involved)
  - — Sense of humor/"humanization"
  - — Enthusiasm and engagement

Teaching

- Plan for each class session by thinking about how students most effectively learn by doing the following:
  - — Decide how to grab student attention.
  - — Identify the purposes of the course session.
  - — Find ways to help students connect each session with their own personal experiences or with previous course sessions.
  - — Quickly review where the current class is headed relative to previous classroom sessions.
  - — Develop creative ways to actively involve students at frequent intervals.
  - — Give students an opportunity at the end of a session to think about the important things they have learned.
- Determine if the distance instructor should spend most of the time teaching or if students should spend most of their time learning or interacting with the teacher and each other.

Interacting (Reaching)

Michael Moore, director of the American Center for the Study of Distance Education at Pennsylvania State University, has identified three types of interaction that can take place in distance learning.

- Learner with instructor
- Learner with learner
- Learner with content

Each of these types of interaction can be addressed in instruction in the following ways.

- By establishing the expectation that interaction will be an integral part of the course, particularly learner to learner.
- By planning for different types of interactions when developing session outlines or interactive presentation guides.
- By selecting the type of interaction that is best suited to helping students understand the content being presented, including

— cooperative learning teams,
— case studies,
— brainstorming activities,
— simulations,
— carefully developed questions,
— games.

- By devoting 50 percent of instructional time to interaction.
- By deciding how to move from passive instruction to active instruction in which learners are thoroughly engaged and vigorously processing the content or learning experiences.

Visuals, Copyright Considerations, and Apparel

Visuals

Television is a powerful visual medium. If used appropriately, it can be very effective in helping students "see" what a teacher is trying to communicate. Think about visuals currently used in the class and adaptations that may be needed in preparing instructional television (ITV) instruction. Visuals are most effective when used to

- increase interest and motivation,
- present and summarize major points,
- illustrate visual components of the content being presented.

Visuals that do not work well over television include the chalkboard, overhead projectors, and transparencies.

Visuals that do work well are

- videotape roll-ins,
- photographs and slides,
- models and demonstrations,
- print material in bold type (Helvetica is a good, clear font),
- computer graphics or electronic text,
- graphics prepared for the document camera in a three by four visual ratio, with no more than seven lines for visual clarity.

Copyright Considerations

- Teachers need to obtain written permission to use copyrighted material.
- When ordering or purchasing new instructional material, request permission to use it in an electronic classroom.

Apparel

No special clothing or make-up are necessary. Dress as if it was a regular class. However, here are some suggestions on what to avoid wearing.

- Reflective jewelry
- Clothing with
  — busy patterns
  — horizontal patterns
  — small checks

Some cameras have a hard time adjusting to reds, bright whites, and other bright colors. Work with the technician and experiment with what looks good on camera.

Classroom Facilitators

Facilitators play many critical roles in distance learning, whether such learning is delivered through television or other technologies.

- They are liaisons between the instructor, students, administration, and technicians.
- They tend to humanize the system.
- They are the classroom manager.
- They are the primary classroom technicians.
- They are proctors for tests.
- They provide student services such as recordkeeping, enrollment, and instructional support.

Based on their role in the particular classroom setup, consider what should be expected of classroom facilitators.

- Should they know what the distance instructor wants them to do?
- Should they be comfortable with the distance technology equipment? Should they be trained to use it?
- Should they have prior contact with the instructor?

Management of the Remote Classroom

Management of the remote classroom will depend somewhat on the design of the system. If a return video link provides a view of distance students, it is easier to monitor them. However, it is important that someone at the distant learning site be in charge of providing both technical and instructional support for the distance instruction.

Here are some questions to consider in managing a remote classroom.

- How will the students receive their textbooks?
- How will the instructor monitor student attendance?
- How will the instructor handle student evaluations and exams?

- How can the instructor become available and accessible for students who need assistance?
- What happens if the system technically fails?
- If a facilitator is available, what role does that person play and how can that person assist instruction?
- How will the instructional materials be distributed to the students?
  - — Courier service
  - — Facsimile (fax)
  - — U.S. Mail
  - — Other means

Technology Selection, Working with the Camera, Learner Support Materials, Teamwork

Technology Selection

Distance learning technologies are used to convey the message of the course and to engage students. Among technologies available are videotapes, computer-generated graphics, still photographs, audiotapes, and satellite feeds.

- These are questions to consider when trying to determine whether the technology chosen for a course is instructionally relevant.
  - — Is the technology the best way to present material for primary instruction?
  - — Is the technology the best way of presenting information?
  - — Does the technology improve the clarity and pacing of the presentation?
  - — Does the technology give importance to essential information?
  - — Does the technology supplement or support information presented in class?
  - — Does the technology provide a secondary means for delivering essential or especially complex information?
  - — Does the technology present beneficial but nonessential information?
  - — Does the technology contribute to the pacing of the presentation?
- Another question to answer is whether the format or medium of any material being considered is technically supported by the facility housing the distance instructor. For example, does the facility provide for videotape presentations, for satellite feeds, computer graphics, photographic slides, and audiotapes to be played over the system?
  - — If the answer is "yes," be aware of the need to secure permission to use copyrighted materials, provide advance notice to technical support personnel, and explain the status and importance of this material to students.
  - — If the answer is "no," convert or transfer the material to an appropriate format, replicate it in another medium, or select alternative material. Once a solution has been arrived at, see points under "if yes" above.

Working with the Camera

- Those who make distance instructional presentations should be aware of these guidelines for moving on camera.
  - — Keep movement as smooth as possible.
  - — Move relatively slowly.
  - — Confine movement to a predetermined area.
  - — "Telegraph" movements to the camera operator.
  - — Be aware of which camera is "live." Movement frequently is a catalyst for camera change, so agree in advance if that will be a signal.
  - — Do not block essential information with any movement. This would include information presented on blackboards, in demonstrations, in graphics, or by guests.
- Relating to the camera also is important. Here are some tips.
  - — Be natural.
  - — Look at the "person" to whom you are speaking. Remember, the distance learner is on the other side of the camera.
  - — Remember that most, if not all, of your students are not present physically.
  - — Use facial expressions, body language, and other nonverbal communications as you would in direct conversation. But tailor them to television.
  - — While speaking, look at the camera as if scanning a group of people.

Learner Support Materials

What types of learner support materials, including interactive study guides and interactive presentation guides, are available to help distance teachers?

- Syllabi, manuals, handouts, or other print materials that outline the flow of instruction and/or course-related information
- Materials that help students process information by completing statements, utilizing graphic organizers, answering questions, and so forth, from information in an instructional presentation

How do learner support materials facilitate the instructional process? They

- allow the instructor to guide student learning more completely,
- help students put information in an appropriate context,
- engage students' attention during class by including them in direct and appropriate learning activities, and
- give students an accurate and focused study guide to use after class.

Teamwork

- The instructor for a distance learning course plays the roles of team leader, content expert, presenter, and instructional manager.
- Other members of the learning team at the origination site are
  - — students,
  - — technical support personnel,
  - — producers,
  - — directors,
  - — technical or program coordinators,
  - — camera operators, and
  - — teaching assistants.
- Additional members of the learning team are located at the remote site. They are
  - — students,
  - — technical support staff,
  - — site coordinators,
  - — camera operators, and
  - — proctors or teaching assistants.

Personal Review Questions

Review class materials and on-camera presentations in reference to the following factors.

- Clarity and organization of the presentation
- Use of appropriate visuals
- Use of appropriate support materials
- Relating to the distance learners through the television cameras or other technology and calling them by name
- Interaction and engagement of the distance learners
- Natural movement on camera
- Sense of humor
- Comfort with the medium

Instructional Telecommunications Technologies Assessment Instrument

The survey instrument included in this appendix is designed to help school districts assess their current use of telecommunications technologies. Properly used, it can enable them to

- inventory what technologies are in place,
- assess how these technologies are used instructionally, and
- survey where each of these technologies are physically located in the district—for instance in classrooms, library media centers, Title I rooms, or offices.

The instrument consists of two forms. The first form can be used to inventory technologies on the classroom level. The second form concerns building- and district-level reporting, and it can be completed using data collected from the classroom survey.

Assessment

Educators can use this two-part assessment instrument to assess availability and use of the following technologies and forms of instructional programming:

- satellite,
- fiber optics,
- telephone lines,
- Instructional Television Fixed Service (ITFS),
- public television,
- cable television, and
- public radio.

Classroom data can be aggregated to yield a building technology and instructional use profile, and school building profiles can in turn be aggregated to develop a district profile. Multiple school district profiles can be aggregated to assess regional technology and instructional use.

Data can also be aggregated by classroom levels, subject areas, or both. This type of data may illustrate patterns of early adoption of technologies as well as patterns of need priorities within a school building or district.

Limitations

The instrument that follows can be modified to fit the specific needs of its users. However, it is not designed to yield data on how much is spent to purchase hardware, software, and programming, or on any costs associated with using them instructionally.

This information is not likely to be found at the classroom level. To obtain such cost estimates, a district would have to review its own financial records.

(Sample) Classroom Instructional Technology Use Reporting Form

Directions

Most questions in this survey can be answered with a check mark. Space is provided where questions call for answers that need to be written out or require further explanation. Please take time to fill out this survey as completely as possible. This form may be reproduced.

Building ______________________________

Classroom ______________________________

Level

☐ elementary
☐ middle-subject ______________
☐ secondary-subject ______________
☐ other-subject ______________

Person filling out this survey ______________________________

Telephone number (______)______________________

I. Satellite

1. Does your classroom have access to satellite programming?
   - ☐ I have satellite television.
   - ☐ I have no direct access to satellite television but use taped satellite programming.
   - ☐ I do not use satellite programming. *(If you have checked this statement, skip the rest of this section and go to the next technology.)*
2. Please check the satellite channels or programs you use in your classroom.

☐ ASTS
☐ CNN "Newsroom"
☐ C-SPAN
☐ C-SPAN II
☐ Classroom Earth
☐ Discovery Channel
☐ Learning Channel
☐ Local PBS channel(s)
☐ Louisiana Educational Satellite Network (NASA programs)
☐ Mind Extension University
☐ Nickelodeon
☐ SCISTAR (science)
☐ SCOLA (foreign language newscasts)
☐ Satellite Educational Resources Consortium (SERC)
☐ TI-IN
☐ WVIZ (Cleveland)
☐ XPRESS XChange
☐ Teleconferences/special media events
☐ Staff development and inservice programs
☐ Other channels (Please list all of them.)

____
____
____
____
____
____

II. Fiber Optics

1. Is your classroom equipped with fiber optics?
   - ☐ I have fiber optics.
   - ☐ I have no direct access to fiber optics but use taped fiber optics programming.
   - ☐ I do not use fiber optics programming.
2. Will your classroom be attached to fiber optics cabling

☐ in the next year? ☐ in the next three years? ☐ in the next five years?

3. Please identify the instructional uses of fiber optics in your classroom. (*If you do not use fiber optics, skip the rest of this section and go to the next technology.*)

____

____

____

____

____

4. Please identify classes and programs your district produces locally that are distributed to your classroom via fiber optics.

____

____

____

____

____

III. Telephone Lines

1. How many computers do you have in your classroom? __________
2. How many classroom computers are networked? __________
3. How many classroom computers have modems? __________
4. Please indicate whether you use telephone lines and audio conferencing.
   - ☐ I have direct access to telephone lines.
   - ☐ I have no direct access to telephone lines, but I use audio and computer conferencing in my curriculum.
   - ☐ I do not use audio conferencing or computers with modems. (*If you have checked this statement, skip the rest of this section and go to the next technology.*)
5. Please check all the ways in which telephone lines are used in your classroom.
   - ☐ Two-way ETN courses and programs
     - ☐ student ☐ staff development ☐ adult/community education
   - ☐ Other audio-only conferencing activities
     - ☐ student ☐ staff development ☐ adult/community education
   - ☐ Audiographics courses and programs
     - ☐ student ☐ staff development ☐ adult/community education
   - ☐ Audio return system for ITFS courses/programs
   - ☐ Audio return system for satellite courses/programs
   - ☐ Facsimile (fax)
   - ☐ Computer modem communications
     - ☐ electronic mail (e-mail) ☐ file transfer ☐ Internet
   - ☐ Online database searches
     - ☐ BRS
     - ☐ DIALOG
     - ☐ ERIC
     - ☐ LEXIS/NEXIS
     - ☐ NewsNet
     - ☐ VU/TEXT
     - ☐ Wilsonline
     - ☐ Others ____________________

       ____

       ____

- ☐ Electronic bulletin boards
  - ☐ AppleLink
  - ☐ AT&T Learning Network
  - ☐ CompuServe/The SOURCE
  - ☐ EDLINE
  - ☐ GTE Education Network
  - ☐ Learning Link
  - ☐ NASA Spacelink
  - ☐ National Geographic Kids Network
  - ☐ PALS across the World
  - ☐ Special Net
  - ☐ TechNet
  - ☐ WiseNet
  - ☐ Others
- ☐ Other uses

IV. Instructional Television Fized Services (ITFS)

1. Please identify the ITFS system that serves your district.

- ☐ I have ITFS in my classroom.
- ☐ I have no direct access to ITFS but use taped ITFS programming.
- ☐ I do not use ITFS programming in my classroom. *(If you have checked this statement, skip the rest of this section and go to the next technology.)*

2. Please name all locally produced instructional programs distributed to your classroom via ITFS, including student courses, enrichment programs, staff development and inservice programs, community education, and so forth.

3. Please identify the student courses or staff development and inservice programs produced nationally or statewide that are delivered to your classroom via ITFS.

- ☐ Oklahoma State University (ASTS)
  - ☐ student courses ☐ staff development and inservice programs
- ☐ SERC
  - ☐ student courses ☐ staff development and inservice programs
- ☐ Teleconferences and special events
  - ☐ for students ☐ staff development and inservice programs
- ☐ STEP Star
  - ☐ student courses ☐ staff development and inservice programs
- ☐ TI-IN
  - ☐ student courses ☐ staff development and inservice programs
- ☐ University of Wisconsin System or UW-Extension telecourses and programs
  - ☐ student courses ☐ staff development and inservice programs
- ☐ Wisconsin Technical College System (WTCS) telecourses and programs
  - ☐ student courses ☐ staff development and inservice programs

☐ Other student courses or staff development programs delivered via ITFS.

____
____
____
____

V. Public Television

1. Please list public television stations that serve your community.

____
____
____

☐ I have direct access to public television in my classroom.
☐ I do not have direct access to public television in my classroom but use taped programming.
☐ I do not use public television programming in my classroom. (*If you have checked this statement, skip the rest of this section and go to the next technology.*)

2. Please identify shows from "Parade of Programs" used in your classroom, whether live or taped.

____
____
____
____
____

VI. Cable Television

1. Please indicate whether you use cable television programming in your classroom.
   ☐ I have cable television in my classroom.
   ☐ I have no direct access to cable television but use taped cable television programming.
   ☐ I do not use programming from cable television in my classroom. (*If you have checked this statement, skip the rest of this section and go to the next technology.*)
2. Please check all instructional cable television channels available to your classroom.
   ☐ A&E Classroom
   ☐ CNN "Newsroom"
   ☐ C-SPAN
   ☐ C-SPAN II
   ☐ Consumer News and Business Channel
   ☐ Discovery Channel
   ☐ Learning Channel
   ☐ Local PBS channel(s)
   ☐ Mind Extension University
   ☐ Nickelodeon
   ☐ Weather Channel
   ☐ XPRESS XChange (a data channel)

   ☐ Local public, educational, or community-access channel(s).
   ☐ (Please specify what kind and how many of each.)

   ____
   ____
   ____

   ☐ Other Channels

   ____
   ____
   ____

3. List cable channels that provide your class with programming, either live or taped.

4. Name the courses, student enrichment, and staff development programs produced locally and viewed in your classroom on cable television.

VI. Public Radio

1. Please identify instructional stations your community has access to on public and Subsidiary Communication Authorization (SCA) radio.

☐ I have direct access to public broadcast and/or SCA radio in my classroom.
☐ I have no direct access to public broadcast and/or SCA radio in my classroom but use taped public broadcast and/or SCA radio programming.
☐ I do not use public broadcast and/or SCA radio programming in my classroom. *(If you have checked this statement, skip the rest of this section.)*

2. Identify radio shows from the "Parade of Programs" used in your classroom.

3. Please identify the classes, programs, or student services your district produces locally and distributes via radio.

Building / District Instructional Technology Use Reporting Form

Directions

Compile these profiles using information from the "Classroom Instructional Technology Use Reporting Form" in this appendix. This form may be reproduced.

Building ____

I. Satellite

1. What type of satellite dish does your building/district have? Check all that apply. If there is more than one satellite, please place the number of them in the blanks below instead of a check mark.

☐ Ku-band _______	☐ C-band _______
☐ fixed _______	☐ fixed _______
☐ steerable _______	☐ steerable _______

2. What percentage of school buildings in your building/district have access to satellite programming? _______ percent
3. What percentage of classrooms in your building/district have access to satellite programming? _______ percent

II. Fiber Optics

1. What percentage of buildings in your district have fiber optics cabling? _______ percent
2. What percentage of buildings in your district will be attached to fiber optics cabling?
   _______ percent in the next year
   _______ percent in the next three years
   _______ percent in the next five years
3. What percentage of classrooms in your building have fiber optics cabling? _______ percent
4. What percentage of classrooms in your building will be attached to fiber optics cabling?
   _______ percent in the next year
   _______ percent in the next three years
   _______ percent in the next five years

III. Telephone Lines

1. What percentage of classrooms in your building/district have long-distance telephone lines for instructional purposes? _______ percent
2. How many computers are there in your building/district? _______
3. How many of the building/district computers are networked? _______
4. How many of the building/district computers have modems? _______
5. How many classrooms in the building/district use telephone lines for audio conferencing? _______
6. How many classrooms in the building/district use telephone lines for computer conferencing? _______

IV. Instructional Television Fixed Services (ITFS)

1. What percentage of classrooms in your building/district are wired for narrowcast ITFS? ________ percent
2. What percentage of classrooms in your building/district use locally produced programming from your ITFS studio or local ITFS system? ________ percent
3. What percentage of classrooms in your building/district use nationally or statewide programming (SERC, TI-IN, ASTS, or special event teleconferences) retransmitted by ITFS? ________ percent

V. Public Television

1. What percentage of classrooms in your building/district have access to public television? ________ percent
2. What percentage of classrooms in your building/district use programs from the "Parade of Programs," either live or taped? ________ percent

VI. Cable Television

1. What percentage of classrooms in your building/district have cable television? ________ percent
2. What percentage of classrooms in your building/district use programming from cable television? ________ percent
3. What percentage of classrooms in your building/district use data sources (XPRESS XChange) from cable television? ________ percent

VII. Radio

1. What percentage of classrooms in your building/district have access to broadcast radio? ________ percent
2. What percentage of classrooms in your building/district have access to SCA radio? ________ percent
3. What percentage of classrooms in your building/district use programming from broadcast radio? ________ percent
4. What percentage of classrooms in your building/district use programming from "school radio," that is, SCA radio? ________ percent

Instructional Telecommunications Plan and Implementation Process Checklist

An instructional telecommunications plan is, in effect, a blueprint for a school district's future. Armed with such a plan, Wisconsin educators can use various technologies to offer students new learning opportunities. However, incorporating instructional telecommunications into a district's curriculum is a very complicated process. Detailed explanations of the many different phases, steps, and procedures involved in creating and implementing such a plan are provided in *Instructional Telecommunications: A Resource and Planning Guide*, published by the Wisconsin Department of Public Instruction (DPI). In an attempt to keep districts on a safe path while plotting their involvement with instructional telecommunications, the guide even lists a number of the pitfalls districts can encounter.

This appendix takes the steps described in the guide for creating and implementing an instructional telecommunications plan and breaks them down into a checklist that educators may reproduce for their own use. The checklist format was chosen because of the great number and complexity of both the activities to be carried out and the issues that arise when school districts decide to select and integrate telecommunications technologies into the classroom. Some components of this checklist grew out of an extensive review of distance learning literature (*see "References" at the end of this appendix*). Input also was provided by teachers, administrators, and staff members representing kindergarten through 12th-grade (K-12) and postsecondary schools throughout the state.

The planning model outlined in the DPI guide consists of four major phases. The checklist describes and subdivides them into incremental steps that can be checked off as they are completed.

I. Creation of a district plan
II. Implementation of the plan
III. Evaluation of the plan and implementation process
IV. Modification of the plan and implementation process

Because each phase consists of a complex set of activities, it is recommended that districts incorporate all or most of the components outlined. Nonetheless, this model may be adapted to best fit the circumstances in each district. It is important to note that, even though broken out separately, some of these steps can and will be done simultaneously.

I. Creation of a District Plan

Creating the district plan is the most time-consuming phase of the planning process. These are the steps to follow. They are described and subdivided into smaller increments in the rest of this section.

A. Selecting a steering committee
B. Writing a philosophy and rationale for the district plan
C. Defining the scope of the instructional and technological assessments
D. Conducting an instructional needs assessment
E. Conducting a technology needs assessment
F. Creating an instructional telecommunications plan

A. Selecting a Steering Committee

The steering committee manages planning, defines the goals and objectives of a plan, conducts instructional and technological needs assessments, and issues the final report to the community.

1. Size. The steering committee should be relatively small in number. At a minimum, it should include these staff members.

☐ The district administrator or a representative
☐ The building principal, or a representative, from each building in the district
☐ The district curriculum coordinator
☐ The district library media director or a school library media specialist
☐ The district computer coordinator or other technology teacher
☐ One or more classroom teachers, preferably one each from the elementary, middle, and secondary levels
☐ One or more guidance counselors
☐ The teachers' union president or a representative
☐ One or more members of the school board
☐ One or more student representatives
☐ One or more parents

2. Responsibilities. The steering committee will be responsible for ensuring completion of the following major steps in the planning process.

☐ Writing a philosophy statement and a rationale for undertaking the planning process
☐ Defining the scope of the assessment
☐ Determining existing sources of information to assess the district's instructional and technological needs
☐ Deciding what data must be collected
☐ Setting timelines for completing the planning process
☐ Developing a district instructional needs profile
☐ Developing a district technological needs profile
☐ Creating an implementation plan based on the activities completed above

B. Writing a Philosophy and Rationale for the District Plan

1. The philosophy statement should

☐ explain the motivations that led the district into involvement with telecommunications technology,
☐ describe the assumptions and beliefs upon which the plan is based,
☐ suggest the general results the plan is designed to produce,
☐ provide direction and focus for district efforts,
☐ communicate current thinking of district decision makers to staff, students, and the community, and
☐ be instrumental in developing a broad base of support from staff, students, and the community.

2. The written philosophy could include

☐ a statement about the mission of the school district,
☐ assumptions about the future,
☐ "why use" technology statements,
☐ "we believe" statements, and
☐ a list of general concepts.

C. Defining the Scope of the Instructional and Technological Needs Assessments

The scope of the instructional and technological needs assessments will be based on the philosophy and rationale the steering committee writes. This scope could focus on various levels and/or areas.

☐ The building level
☐ The district level
☐ The state level
☐ A regional level, whether consisting of a few neighboring school districts or a cooperative educational service agency (CESA) as a whole
☐ A grade-specific level, such as fourth, eighth, or tenth grade
☐ A curriculum content area, such as mathematics, science, social studies, or foreign languages
☐ A special need area, such as children with exceptional educational needs (EEN), gifted and talented students, Title I program participants, children at risk, or English as a second language students (ESL)
☐ Any combination of these

D. Conducting an Instructional Needs Assessment

There are five steps necessary to conducting a comprehensive assessment of a school district's instructional and telecommunications technology needs. They are described and subdivided into smaller increments in the remainder of this section.

1. Determining existing sources of information
2. Deciding what data has to be collected
3. Writing a vision for the future
4. Setting timelines
5. Developing an instructional needs profile

1. Determining existing sources of information and/or data to assess the district's instructional needs and telecommunications technology resources.

a) A "need" is identified as the discrepancy between the current instructional state of a district or school and what officials would like it to be in the future.

b) These are some of the existing data and information resources that can be inventoried as part of an assessment.

☐ Current and projected student and staff demographic profiles by district, building, grade level, and subject area
☐ Current, past, and projected student course enrollment patterns by district, building, grade level, and subject area
☐ Special needs plans or studies in progress for such populations as children at risk, EEN students, gifted and talented students, and so on, by district, building, grade level, and subject area
☐ Staff development programs and needs by district, building, grade level, and subject area
☐ Annual Standard (k) curriculum reports
☐ Annual school district budget reports
☐ Annual Standard (o) performance disclosure reports
☐ School Evaluation Consortium reports
☐ Student audits
☐ Other ongoing curriculum work
☐ Standards audit reports

☐ Annual standardized test results
☐ Other sources the steering committee decides could be used for both the instructional needs and technology needs assessments

2. **Deciding** what data has to be collected and stating why.

a) The purpose of this step is to match data elements to be collected with the focus of the rationale for participating in a planning process. The focus of the rationale should include identifying the current instructional offerings of the district and gathering opinions of staff, students, and the community on future instructional opportunities they want. Such an instructional profile should cover these matters.

☐ Instructional course offerings by district, building, and grade level as appropriate to the level at which the assessment is directed
☐ Student support services, including guidance, counseling, Title I programs, reading labs, gifted and talented programs, and so forth, by district, building, and grade level as appropriate
☐ Program support resources such as instructional media center services, language and computer labs, ratios of computers to students and to faculty, and so forth, by district, building, and grade level as appropriate
☐ Professional staff development by district, building, grade level, and subject area as appropriate

b) The next step involves identifying and finding a source for data elements that are needed but are not currently collected or available in the district. Among such data and sources might be

☐ reports gathered and housed at the Department of Public Instruction (DPI),
☐ school "report card" comparisons from the DPI,
☐ high school graduate follow-up information to track the effectiveness of the school's teaching on postsecondary school performance, and/or
☐ demographic, economic, or community development studies completed by local businesses, local units of government, or institutions of higher education.

c) Once the types of data to be collected have been selected, the steering committee must answer the following questions.

☐ (1) Where is the data located?
  ☐ District offices
  ☐ School building(s)
  ☐ The state level
  ☐ Local businesses, units of government, or institutions of higher education
  ☐ Other locations
☐ (2) What data is not currently available but must be collected by district, building, grade level, or subject area as appropriate?
☐ (3) What methods will be used to collect the data?
  ☐ Databases ☐ Interviews ☐ Survey ☐ All of these
☐ (4) What staff and support services are necessary to conduct the needs assessment by district, building, grade level, or subject area as appropriate?

3. **Writing** a vision for the future of the school district. Input for this step can be gathered using two distinctly different methods.

a) Ask staff, students, and the community to respond to a written survey in order to accomplish these goals.

☐ Assess the degree of satisfaction or dissatisfaction with the current instructional program.
☐ Prepare a "wish list" for instructional courses or opportunities they would like to see offered in the future.
☐ Make a "wish list" of technologies they would like to have in the schools in the future.

b) Have the steering committee create a model vision statement explaining the instructional courses and opportunities and technologies they think should be introduced in the future. After that, elicit reactions to this model from staff, students, and the community.

4. Setting timelines for completing the assessment. There are two types of timelines to be identified.

a) Completion dates for the final instructional needs assessment so the district can meet deadlines mandated by other government agencies, by public groups, or by private concerns regarding budgets, construction timetables, and so forth.
☐ Annual school/district budget or reporting requirements
☐ Annual CESA or consortia budget requirements
☐ Biennial state budget proposals/requests
☐ Periodic budget or reporting requirements such as local, state, federal, and other grant application schedules, or district planning and building construction timetables

b) Completion dates for data collection to ensure enough time to aggregate, interpret, analyze, and report the data by the final completion dates identified under a).

5. Developing a district instructional needs profile. Such a profile is the combined product of steps 1 through 4.. Once the current instructional program has been identified, the data collected, and the vision for the future written, the next step is to develop an instructional needs profile for the district. A needs profile should answer, at a minimum, the following questions.
☐ What instructional programs or courses should be added to the classroom, building, or district curricula to put them or keep them in compliance with standards they must meet?
☐ What instructional programs and resources could increase learning opportunities in the district, building, or classroom?
☐ What instructional programs are needed to provide for low enrollment classes, ESL classes, special education, enrichment programs, and advanced placement courses for gifted and talented students?
☐ What are the most critical staff development needs for teachers, support services staff, and administrators?
☐ What local, regional, state, or national program or service providers would the district like to add to address the needs identified?
☐ What instructional programs or student or staff support services are currently offered on a shared basis with other school districts, either directly or through a CESA?
☐ What postsecondary education institutions provide instructional programs for students, staff, and community or offer staff or student support services to the district?

E. Conducting a Technology Needs Assessment

The technology needs assessment may be conducted at the same time as the instructional needs assessment. The "Instructional Telecommunications Technologies Assessment Instrument" in appendix E can be modified to collect information about districts, buildings, and classrooms.

Instructional telecommunications technology data collected at the classroom level can be aggregated for a profile of the school's technology, while information on individual buildings may be aggregated to assess the district's overall instructional technologies. If a district takes part in a regional or state planning process, the district profile can be aggregated with those of other units in the study for a picture of the entire region. Here are the required elements of a technology needs assessment.

☐ 1. A comprehensive inventory of all telecommunications and computer hardware used both instructionally and administratively in each district office, school building, and classroom.

☐ 2. A comprehensive inventory of all instructional classes, programs, software, and resources made available over the technologies inventoried and used instructionally and administratively in each district building. Aggregate this building data for a district inventory.

☐ 3. An assessment of the availability of technologies the district does not yet have. This assessment could cover upgrades or possible networking of the installed computer base in the district, construction of an Instructional Television Fixed Service or fiber optics system in the region, gaining access to the international Internet network and other online computer services, or connection to cable television.

F. Creating an Instructional Telecommunications Plan

The results of the instructional and technological assessments serve as the basis for creating an instructional telecommunications plan. The plan should outline a range of alternatives and specific strategies to match current instructional needs and technology resources with future instructional needs and technology acquisitions.

1. This plan should identify several time frames for implementation.

☐ **a)** A short range of one to three years
☐ **b)** A medium range of four to seven years
☐ **c)** A long range of eight to 12 years

2. The following are steps that should be taken in this part of the planning process.

a) Consider the issues concerning curriculum, technology, and administration raised by each of the strategies identified in the plan. These are some of the questions that have to be answered.

☐ Have teachers been involved in development of the plan so they have a sense of ownership in a process that will affect them greatly?

☐ Do technologies identified in the plan facilitate the type of instruction that meets the district's needs?

☐ Does the plan include inservicing of staff, students, and administrators on new technologies and the instruction they provide?

☐ Does the plan provide a process for coordinating curriculum planning among subject areas in a building, among buildings in a district, or among districts within a consortium?

☐ Does the plan establish procedures for reviewing curriculum and evaluating instruction from these technologies?

☐ Does the plan identify support staff who can repair and replace equipment or help manage the flow of student assignments and records?

☐ Does the plan ensure equal access to these technologies for all students and staff?

☐ Does the plan discuss the effects that policies regarding class size, student selection, and course selection may have on instruction conducted over these technologies?

☐ Does the plan describe back-up procedures in case of technical failure?

☐ Does the plan provide for sufficient instructor-learner interaction through appropriate use of voice, data, and video technologies?

☐ Does the plan satisfy state-level guidelines or rules concerning instructional telecommunications?

☐ Is the plan in accordance with provisions of the current teacher contract?

☐ Does the plan address student and class scheduling conflicts that may arise through use of various technologies?

☐ Does the plan discuss its effects on the school bell schedule and district school year calendar?
☐ Can total costs be determined for equipment, facilities, materials for new technologies, hardware, maintenance, and other expenses?
☐ Will switching to proposed technologies result in annual savings over the current instructional program?
☐ Are staff skilled in implementing, operating, and maintaining proposed technologies available in the district, both during planning and afterwards?
☐ Are administrators with the necessary expertise on hand to manage plan activities and to continue operating new technologies and programs?
☐ Are staff, students, and community members likely to support the plan?
☐ Do key decision makers display a positive attitude toward the plan?
☐ Is support for the technologies widespread or confined to a few individuals?
☐ Are staff and administrative expectations concerning benefits of the plan reasonable?
☐ Is the organizational structure flexible enough to deal with the disruption triggered by the installation and testing of new technologies?
☐ Is there a formal mechanism for handling any procedural or policy modifications necessary to accommodate changes triggered by the plan?
☐ Is there a designated staff member who has responsibility for implementing, maintaining, and operating the technologies? (Kemper, 1988, p. 39)

b) Decide if currently available local telecommunications technologies and/or program providers can enable a district or building to meet its needs. Among questions to be answered are these.
☐ Are courses intended for remedial, average, or advanced students, or a combination of all three types?
☐ Do courses meet state certification requirements?
☐ Are there student enrichment courses?
☐ Are there college preparation or advanced placement courses?
☐ Are there courses to prepare students for standardized tests such as the Scholastic Aptitude Test (SAT) and the American College Test (ACT)?
☐ Are there teacher/administrative staff development courses or adult education classes? (Barker, 1992, p. 8)

c) Decide if other technologies and/or program providers not yet available locally will help a district or building to meet its needs. These are some questions to be answered.
☐ Does the distance program provider allow enough time each semester for makeup work?
☐ How many days each week does the system or program conduct classes?
☐ Can classes be videotaped and viewed later by students who miss a class or portions of a class?
☐ Are a few lessons prepared for broadcast ahead of time in case the distance teacher is unable to conduct the class live?
☐ Do distance teachers have set times outside of the lesson periods during which students can contact them to ask questions or for other purposes?
☐ How early or late in the school day are courses conducted?
☐ How closely aligned are calendars or schedules for the district and for the distance courses and programs? (Barker, 1992, p. 9)

d) Create a process to articulate new content from instructional telecommunications technology with the district's existing curriculum, including board, administrator, and staff development programs. Answering these questions will focus the efforts of those guiding articulation.
☐ Is the content appropriate for the intended grade level?

☐ Does a course or program contain appropriate and easy-to-follow instructions?
☐ Does a course or program have clearly defined learner goals and objectives?
☐ Do these goals and objectives match those established in the district?
☐ Does a course or program use primary and secondary materials and methods that are exciting, motivating, and varied?
☐ Does a course or program meet the needs of the students and adjust for individual differences in abilities, desires, and interests?
☐ Does a course or program contain accurate and up-to-date content according to the latest scholarly opinion?
☐ Is a course or program easy to understand, consistent, and well-organized?
☐ Is the pace of the course or program logical and flexible, especially when taking into consideration the characteristics of the instructional technology being used?
☐ Does a course or program provide for fair, accurate, and appropriate evaluation of student performance and progress?
☐ Does a course or program contain pretests and other diagnostic procedures?
☐ Does a course or program articulate in a clear and appropriate manner with the district's other courses, subject matter, and grade levels?
☐ Does a course or program employ record-keeping practices that are accurate and meaningful?
☐ Does a course or program employ technology appropriate for the content presented and for learners' abilities?
☐ Is the technology used conducive to conveying the content and to facilitating the learning process? (Batey and Cowell, 1986, pp. 13-14)

e) Calculate costs to purchase instructional telecommunications technologies and participate in new courses, programs, and activities. There are five categories of costs.
☐ Capital costs to acquire the actual hardware or facilities
☐ Development costs to put the system into operation and prepare the first presentations
☐ Operation and maintenance costs to keep the system operating
☐ Expansion costs to increase the size of the program
☐ Miscellaneous costs—the expenses associated with the time and energy needed to plan, develop, and implement an instructional telecommunications plan (Batey and Cowell, 1986, p. 25)

f) Identify options to finance the purchase of technologies and plan implementation.
☐ (1) Should a district join local, regional, or national consortia to share costs of instruction, programming, and technologies?
  ☐ (a) Some consortia are based on specific technologies such as ITFS, fiber optics, or satellite.
  ☐ (b) Some consortia are based on instructional programs from specific sources such as regional educational telecommunications areas (RETAs), the Satellite Educational Resources Consortium (SERC), CESAs, or postsecondary schools.
☐ (2) Should the district seek funding from any of these state or federal programs or private foundations to finance instructional telecommunications technology purchases and participation in instructional programs and activities? (Cromer and Steinberger, 1989, pp. 12-13)
  ☐ (a) Elementary and Secondary Education Act, Chapter 1—special education needs for disadvantaged children
  ☐ (b) Goals 2000: Educate America Act—block grants for innovative projects, staff development, and program coordination
  ☐ (c) Star Schools Program grants and special equipment grants from businesses and organizations, such as the Rural Electrification Agency, SERC, NTIA, IBM, Apple Computer Company, or local telephone and cable television companies

☐ (d) Local and national foundations that fund innovative school projects, such as the Kellogg Foundation

☐ (e) Special state legislation

☐ (3) Should the district enter into local school and business partnerships to finance technology purchases and participation in instructional programs? Some of these partnerships provide all or part of the funding for one or more technologies.

g) Calculate a cost-benefit analysis for each alternative strategy identified in the plan. Traditional methods of measuring the cost effectiveness of types of education may not apply to instructional telecommunications programs. Costs in these programs are generally a function of the amount and type of content to be presented, the size and location of the audience, the choice of technology, and the sophistication of the product. There will usually be expenses over and above those involved in delivering traditional instructio[illegible]

II. Implementation of the Plan

Once the plan has been written, reviewed, and authorized by the district's school board, it can be put into operation. Activities to be undertaken are similar to those needed to implement any other district plan, except this one may have more far-reaching consequences than some other projects. Records should be kept so implementation of the plan can be evaluated. Here are the steps required for an effective implementation process. They are described and subdivided in the remainder of this section.

A. Writing a district policy dealing with instructional telecommunications

B. Creating procedures to inform all parties involved about the district plan and the implementation process

C. Conducting a district orientation and staff development program for all parties involved

D. Selecting district and building implementation teams

E. Defining roles and assigning responsibilities for all aspects of the plan

A. Writing a District Policy

A district policy dealing with instructional telecommunications should address these various issues and concerns.

☐ State statutes and administrative rules

☐ Local policy and practice

☐ Wisconsin's 20 educational standards

☐ Provisions of current union contracts

☐ Certification issues

☐ High school graduation requirements

☐ Who will manage implementation of this plan at the district- and building-levels

☐ Who will manage purchases, contracts, and financial agreements in the plan

☐ Who is responsible for enrolling students for telecommunications-based classes and scheduling telecommunications-based classes into the school day

☐ Who recruits, trains, and pays distance teachers and classroom facilitators

☐ Who formally evaluates the performance of distance teachers and classroom facilitators

☐ Who supervises distance teachers and classroom facilitators

☐ Who supervises students in telecommunications-based classes

☐ Who resolves conflicts over the use of technology

☐ Who provides technical support in the district and school building

☐ Class size limits and the criteria for setting them

☐ Other issues the steering committee feels should be considered

B. Creating Informational Procedures

Create ways to inform all parties involved—the school board, district staff, community, and other interested groups—about the district plan. Be sure to address both internal and external audiences.

1. Internal audiences who must be informed about the district plan are

☐ **a)** Administration: principals, school board members, superintendent
☐ **b)** Faculty
☐ **c)** Support staff
☐ **d)** Students

2. External audiences who should know about the plan are

☐ **a)** Community
☐ **b)** Elected officials representing the area on the local and state levels
☐ **c)** Parents of students
☐ **d)** Other educational institutions
☐ **e)** Support groups such as parent teacher organizations

C. Conducting Orientation and Staff Development Programs

1. Orientation. Create a district orientation program that discusses these matters.

☐ **a)** The plan itself
  ☐ Its philosophy and rationale
  ☐ The scope and outcomes of the instructional and technological assessments conducted
  ☐ The steps to be taken to implement the plan in the district

☐ **b)** Concepts of distance learning and instructional telecommunications

☐ **c)** The full range of technologies available and their instructional uses, for example, full courses, enrichment programs, professional development, and community education

☐ **d)** Curriculum development to integrate content from instructional telecommunications offerings

☐ **e)** Student selection and student orientation to distance learning and instructional telecommunications, including how to
  ☐ Learn course content from new sources such as computer databases and teachers located in distant classrooms
  ☐ Ask questions and seek assistance when the teacher is not physically present
  ☐ Use a variety of technologies to augment the lessons coming from a variety of technologies

☐ **f)** Faculty compensation and contract provisions

☐ **g)** Any other issues specific to each district or site

2. Staff Development. Create an ongoing district staff development program that considers these questions and concerns.

☐ **a)** How to prepare teachers to use telecommunications technologies as new tools for teaching an entire course. Appendix D presents a set of questions and recommendations for teaching using interactive television that can also be applied to other technologies. It may also help districts evaluate the presentation formats of program providers they consider. Staff also should evaluate the following changes they may have to deal with in a distance learning environment.
  ☐ Teaching with lesson plans partly or completely developed by others
  ☐ Preparing very detailed lessons well in advance of delivery
  ☐ Teaching without students in physical attendance
  ☐ Teaching with new types of feedback from learners or even no feedback at all

- ☐ Using different methods to help students participate in distance learning classes
- ☐ Organizing and structuring materials in new ways
- ☐ Systematically pretesting materials and explanations for appropriateness, clarity, and comprehensibility
- ☐ Pacing and delivering lessons in new ways
- ☐ Presenting lessons according to strict and inflexible time schedules
- ☐ Creating innovative ways to elicit student participation and response to questions when students are in multiple physical locations
- ☐ Providing access to learner support materials such as remote databases, library catalogs, and print or electronic resources for students in multiple physical locations
- ☐ Balancing multiple materials and inputs to students
- ☐ Planning new ways to meet the social and emotional needs of students
- ☐ Projecting style and personality in new ways
- ☐ Operating new technologies

☐ **b)** The role of the classroom facilitator and the relationship between onsite teacher or facilitator and distance teacher

- ☐ Full-course teacher
- ☐ Co-teacher with the distance teacher
- ☐ Learning partner with the students
- ☐ Monitor of students with little or no part in the learning process

☐ **c)** How to orient facilitators to manage the learning process in a remote classroom

- ☐ Using plans, materials, and teaching methods largely devised by others
- ☐ Keeping to a schedule often made by others
- ☐ Preparing students to receive input in new and different ways
- ☐ Helping students focus their attention on unfamiliar stimuli
- ☐ Helping students make responses in unaccustomed ways
- ☐ Using different methods to aid students in asking for help and assistance
- ☐ Employing new ways to promote student concentration and persistence
- ☐ Evaluating and rewarding students for new behaviors
- ☐ Teaching students to use new hardware and software with ease and confidence
- ☐ Scheduling repairs and maintenance of equipment when indicated, and, on occasion, performing simple repairs
- ☐ Keeping new types of records and doing this in different ways

☐ **d)** Guidelines for selecting instructors to teach directly over a technology

☐ **e)** How to develop student and technical support systems, including ways to facilitate student interaction and participation in a telecommunications-based class

- ☐ Written communication sent by mail, including personal letters, journals, and logbooks
- ☐ Exchange of audio cassettes
- ☐ Telephone contacts, either regularly scheduled or "on demand"
- ☐ Student interaction, either face-to-face or via technology
- ☐ Training for aides or monitors so they can provide help and support to distance students
- ☐ Group scrapbooks or photo albums
- ☐ Peer tutoring systems
- ☐ Tutorial groups, either in or out of school
- ☐ Materials for parents so they can assist their children
- ☐ Electronic mail
- ☐ Imaginative supplementary materials featuring activities to integrate social and emotional concerns with subject matter content

  - ☐ Connection of distance learning to courses in the same subject area taught in a student's school, so the teacher of that course is available for help and advice
  - ☐ Special recognition of schools, classes, or individual students during presentations or broadcasts (Batey and Cowell, 1986)

☐ **f)** Providing student support services for this course—records, grades, homework, assignments, tests, research, guidance, and counseling

  - ☐ (1) Most students need support of various kinds to handle distance education experiences. A distance teacher removed physically from the learner cannot provide the usual guidance and support found in a traditional classroom.
  - ☐ (2) Alternatives to traditional instructional guidance have to be developed.
  - ☐ (3) When support is provided over distance, both frequent contact and a short turnaround time for all communication are crucial for success.

D. Selecting District and Building Implementation Teams

Select district and building teams to facilitate implementation of the plan at their respective levels. The teams also will help staff, administrators, and students integrate instructional telecommunications into every appropriate aspect of school organization and curriculum.

1. A district-level team should include these members.

☐ A representative of administration
☐ A curriculum director
☐ Library media director
☐ Distance learning director
☐ Computer coordinator
☐ ITV contact person
☐ Student support services director
☐ Teachers' union official
☐ Building maintenance director
☐ School board member(s)
☐ Parent(s)
☐ Student(s)

2. A building-level team should include these members.

☐ A representative of administration
☐ Library media specialist
☐ Distance learning coordinator
☐ Computer coordinator
☐ Classroom teachers
☐ Department heads
☐ Student support services personnel
☐ Building maintenance personnel
☐ Parent(s)
☐ Student(s)

E. Defining Roles and Assigning Responsibilities

Define roles and assign responsibilities for carrying out the various duties connected with instructional telecommunications at the district and building levels.

1. District Level

☐ **a)** Who will act as the ongoing districtwide coordinator for all instructional telecommunications programs? These are some of the staff members who might fill this role.

☐ District administrator
☐ Assistant district administrator
☐ District technology coordinator
☐ District distance learning coordinator
☐ Director of curriculum and instruction
☐ District library media specialist
☐ Implementation plan steering committee
☐ Other district-level administrator or group

☐ **b)** Who deals with the ongoing coordination of selecting, purchasing, installing, and providing technical support and maintenance services for instructional technologies?

☐ District library media director
☐ District technology coordinator
☐ District distance learning coordinator
☐ District computer coordinator
☐ Other district-level administrator or group

☐ **c)** Who coordinates the ongoing staff development programs that orient and train staff to integrate instructional telecommunications into their classroom and/or to teach over these technologies?

☐ Director of curriculum and instruction
☐ Director of staff development
☐ District library media director
☐ District distance learning coordinator
☐ Other district-level administrator or group

2. Building Level

☐ **a)** Who will act as the ongoing building coordinator for all instructional telecommunications efforts the school undertakes?

☐ Principal
☐ Assistant principal
☐ Library media specialist
☐ Computer coordinator
☐ Distance learning coordinator
☐ Other technology specialist or interested individual

☐ **b)** Who provides purchasing, installation, and technical support for the instructional technologies in the building?

☐ Assistant principal
☐ Library media specialist
☐ Computer coordinator
☐ Distance learning coordinator
☐ Other technology specialist or interested individual

☐ **c)** Who coordinates and/or provides ongoing staff development programs in the building?

☐ Principal
☐ Assistant principal
☐ Library media specialist
☐ Computer coordinator
☐ Distance learning coordinator
☐ Guidance counselor
☐ Staff development committee
☐ Other interested individual

☐ **d)** Who deals with the academic records, grades, and attendance records for distance learning classes?

☐ **e)** Who coordinates the selection, scheduling, and registration for student courses, staff development, or special events?

III. Evaluation of the Plan and Implementation Process

This phase gives the implementation teams periodic measurement of progress on the establishment and operation of the plan elements. Evaluation should occur from the very beginning and all plan and implementation process elements should be designed to be easily evaluated.

A. Kinds of Evaluation

Three kinds of evaluation should be done to measure the effectiveness of district efforts.

☐ 1. There should be an overall analysis of the implementation process itself, using both formative and summative evaluation techniques. This checklist can help district personnel conduct formative and summative evaluations, because it contains all the steps and activities necessary to create and implement the district plan.

☐ 2. Staff utilization and curriculum adaptation should be evaluated. Included in this evaluation should be an assessment of behavioral changes in how staff members deliver or manage instruction over technology and how they alter course content or daily lessons to accommodate new technologies. Using appendix D could help districts evaluate staff utilization and course content conversion to a delivery system based on instructional telecommunications.

☐ 3. Also to be evaluated are the knowledge, attitudes, and skills students gain from the introduction of new technology into the instructional program. What is learned will be evaluated through ongoing testing activities in the classroom and the district, including possible participation in statewide mandatory testing programs.

B. Evaluation Strategy

Here are some guidelines to keep in mind when designing a strategy for evaluating the plan and its implementation process.

☐ 1. A rationale should be established to explain the purpose of the evaluation and how the results will be used.

☐ 2. Recipients of the evaluations should be identified.

☐ 3. Key participants in the implementation of the plan should be involved in developing the evaluation procedure.

☐ 4. A variety of approaches should be used to gather the information.
  ☐ Surveys of students and staff using the technologies
  ☐ Questionnaires for students, staff, and community members
  ☐ On-site observations by educators and technical experts in the participating schools
  ☐ Interviews with students and staff using the technologies
  ☐ Test results and high school equivalency diploma examination scores
  ☐ Case studies
  ☐ Analysis by teachers and administrators of videotaped segments of selected classroom interactions (New York Legislative Commission on Science and Technology, 1988, p. 31)
  ☐ Other relevant means for gathering data and information

☐ 5. Staff, students, and community members should be included in the evaluation.

☐ 6. It is important to monitor the process of instructional content development as well as to record test results.

☐ 7. Evaluation is an ongoing process. Evaluation results should be used to assist in revision of the plan and to aid in making decisions as well as to provide appropriate information on the accomplishment of plan activities (Minnesota Curriculum Services Center, 1983, p. 55)

IV. Modification of the Plan and Implementation Process

A. In the fourth phase, the plan and implementation process are modified to better reflect the realities encountered during implementation. Basic components to be considered are

☐ 1. the plan;
☐ 2. the short-, medium-, and long-term time lines; a
☐ 3. the implementation process evaluation data.

B. Modification should be done when evaluation data indicates there is a need to redirect or alter a particular part of the plan or implementation process, or the plan as a whole, to address new information or technologies that have emerged during the implementation phase. These modifications should be linked to the existing elements of the plan and relate directly to meeting the instructional needs identified in the plan. This ought to be done within the implementation timelines already set.

Plan modification should be done annually to keep the implementation process on a track that is cost effective for the district and instructionally effective for students and staff. The annual review of the implementation plan should include these steps.

☐ 1. The steering committee should coordinate this process and make any recommendations for revising the plan based on the review.

☐ 2. The evaluation checklist provided in sections I through III above should be used to match actual implementation outcomes with anticipated outcomes identified in the plan.

☐ 3. The steering committee should establish priorities for changing the plan based on this review. Priorities could address changes in the following items.

- ☐ a) The facilities that house the technologies and the classrooms and library media centers that serve as learning environments for these technologies
- ☐ b) Hardware and technologies purchased
- ☐ c) Staff development and staff support programs initiated
- ☐ d) Instructional software purchases
- ☐ e) Equity and access policies
- ☐ f) Curriculum integration needs
- ☐ g) Budget considerations
- ☐ h) Other concerns indicated in the evaluation

☐ 4. The steering committee should develop a revised implementation plan and schedule.

☐ 5. The steering committee must carry out changes outlined in the revised plan and implementation process.

☐ 6. To evaluate the impact of this revised implementation plan, the steering committee should

- ☐ a) revise the evaluation checklist in sections I through III above to reflect the revisions, and
- ☐ b) evaluate the revised plan which includes the changes.

☐ 7. Begin the whole cycle again.

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Appendix G

Glossary of Terms

This glossary is adapted from one created for the *Wisconsin Distance Education Technology Study* (June 1993) by Evans Associates. Some technical terms and abbreviations from the original have been deleted because they are not relevant to this guide. This glossary was originally downloaded by computer from the Library on Learning Link. Anyone interested in the full glossary can obtain it from Learning Link.

This glossary contains definitions for terms often used in discussions of distance learning, also called *distance education*. Where appropriate, the definitions are given in the context of the Wisconsin Educational Communications Board (WECB) system.

A, B, C, D, G channel groups ITFS channels are clustered in groups of four frequencies designated by a letter of the alphabet and a number—A-1, A-2, A-3, A-4.

ad hoc teleconference A teleconference that links participants for a specific purpose.

ADM Add-drop multiplexer: a piece of equipment that makes possible a dynamic software-controlled configuration of circuits in a digital switched network.

AM Amplitude modulation: encoding of a carrier wave by varying its amplitude.

amplifier An electrical device to strengthen audio signals, video signals, or radio frequency (RF) energy.

analog/digital Two opposite kinds of communication signals. **1.** *Analog*. An analog signal transmits information by modulating a continuous signal, such as a radio wave. **2.** *Digital*. A digital signal is based on a binary code in which information is sent as a series of "on" and "off" signals. It is more precise and less subject to interference than an analog signal.

antenna A structure that receives or transmits radio or television signals.

ASCII American Standard Code for Information Interchange: the common code for alphanumeric characters that enables different computer systems to communicate.

asynchronicity/asynchronous The capability of a communications technology to store and record programming for later playback or use. Another term sometimes used to refer to a technology that has this capability is "time-independent."

attenuation Occurs when electromagnetic signals suffer a loss of power during transmission.

audio Sound energy that codes information understandably for a human listener.

audio conference A telephone conference call utilizing special equipment to maintain the strength of the signal among all parties.

audiographics The simultaneous two-way transmission of voice and computer graphics over ordinary telephone lines; allows for a high degree of interaction, because several sites may be linked at one time.

audio subcarrier The carrier wave that transmits audio information between 5 and 8.5 MHz on a satellite broadcast.

audiotex or audiotext A system employing touch-tone telephones to access electronically stored and delivered libraries of short audio messages.

bandwidth The amount of the electromagnetic spectrum that a given signal occupies. Usually expressed in kilohertz (thousands of hertz, or KHz) or megahertz (millions of hertz, or MHz).

baud rate The speed of data transmission over telephone lines, approximately equal to bits per second. Baud rates for ASCII computer messaging services range from 300 to 14,400 and above.

BER Bit error rate: the fraction of a sequence of message bits that are in error. A bit error rate of 106 means there is an average of one error per million bits.

B-ISDN Broadband Integrated Services Digital Network: a digital signalling network that operates with interface data rate speeds of 155 to 622 million bits per second (MBs).

bit Binary digit: a bit is the smallest unit of information a computer can process. It is represented by a *1* or *0*, or by *on* or *off*.

block downconverting The process of converting an entire band to an intermediate frequency (4 GHz to 1 GHz) for transmission to multiple receivers, where the next conversion will take place.

bridge A device that connects three or more telecommunications channels, such as telephone lines.

broadband Broadband channels have enough bandwidth to carry full-motion video, still pictures, graphics, audio, and text.

broadcast Television and radio signals designed to reach mass audiences. The audio or video signal is transmitted from a central point and is received on standard radio or television equipment.

byte A group of bits, usually eight, processed as a unit by a computer.

CAD Computer assisted design: computer drawing software designed to create visual representations in color, according to scale, and in multiple dimensions.

CAI Computer assisted instruction.

CAM Computer assisted manufacturing.

camera An instrument that converts a visual image into electrical impulses for video transmission.

carrier **1.** A provider of communication transmissions to the general public, sometimes referred to as a "common carrier" or "regulated carrier" because it is regulated by the Federal Communications Commission (FCC). **2.** A current in a communications channel that can be modulated to carry analog or digital signals. **3.** A telephone company or similar nonprivate telecommunications service supplier. **4.** The radio frequency wave that is modulated by the baseband information signal.

CATV Community Antenna Television: a master antenna and distribution system to receive, amplify, and distribute a television signal via coaxial cable. Also known as cable television.

C-band satellite television Channels from 4 to 6 gigahertz used mainly to transmit and receive signals involving communication satellites. Satellites operating in the C-band transmit the majority of programming for broadcast and cable television, telephone transmissions, and data.

CCTV Closed-circuit television: a system that transmits TV signals only to receivers that are physically connected.

CD-ROM Compact disc with read-only memory: a technology for storing information that can be read by a computer or similar hi-tech device. It uses the same technology as audio compact discs and movie videodiscs.

cellular radio A mobile telephone technology that divides a metropolitan area into a number of smaller areas or cells, each served by a small, low-power transmitting and receiving station. A car traveling from one cell to another is automatically switched to that cell's particular frequency, allowing for continuous en route communications. Each transmitting station is connected to a mobile phone switching office and the local telephone switching center.

Centrex A telephone company switching service that uses central office switching equipment to connect customers via individual extension access lines.

channel A band of frequencies allocated for communications.

channel bands for television *Low band.* VHF channels two through six. *Mid band.* Cable channels 14 through 22. *High band.* Cable channels seven through 13. *Super band.* Cable channels 23 through 36. *Hyper band.* Cable channels 37 through 59. *UHF.* Broadcast television channels 14 through 83.

coax, coaxial cable Copper-wire cable that carries audio signals, video signals, and radio frequency (RF) energy.

Codec Coder/decoder: digital encoding/decoding equipment necessary to interface analog end-user equipment such as a television set with digital transmission facilities. In the case of compressed video, codecs also restore some of the motion lost in the compression process.

common carrier A telecommunications company that provides communication transmission services, at a fee, to the public. A local telephone company is an example of a common carrier.

communications satellite A satellite that receives signals from an Earth station and retransmits them to other Earth stations.

compressed video In compressed video only the changes in moving frames are captured and transmitted, not full motion. The reconstituted image exhibits some motion and, depending on the available bandwidth and capacity of the transmitters and receivers, the motion may appear somewhat irregular. This effect occurs in compressed video technology because the moving areas of the image are only approximated.

computer conferencing An interactive conferencing system that enables participants to share comments, texts, graphics, or other forms of information. Users can access the conferencing system with computers at any time, read material submitted by other participants, and add their own comments.

computer messaging systems Included among these are electronic mail, bulletin boards, and computer conferencing. Such systems include a central "host" computer, which stores messages, and other members who access the system and exchange information with telecommunications technologies.

conference call A call over ordinary telephone lines that links a number of locations together with the aid of a telephone company or telephone bridging device.

connectivity The ability of devices to exchange data through shared connections.

consortium A voluntary organization whose members are affiliated for a specific purpose.

CPE Customer premises equipment: phones, private branch exchanges (PBXs), and other telephone equipment located on a customer's premises.

CPU Central processing unit of a computer.

CRT Cathode ray tube.

C-SPAN Cable-Satellite TV Public Affairs Network.

CWETN Central Wisconsin Educational Telecommunications Network: a consortium of schools located near Spencer that share an interactive television network.

DAC or DCS Digital cross-connect switch: a remote device controlled by a central site switch that can route data, voice, or video signals to a specific destination.

database Information storage system that can be searched to obtain specific data. The term *database* in the past was associated only with computers. Today it also refers to information storage and retrieval systems involving other technologies, such as audiotext and teletext.

data rate Analog transmission is specified in bandwidth (usually in hertz) and signal to noise (usually in dB). A digital user measures capacity by how many bits per second can be transmitted.

dB Decibel: the standard unit of difference used to measure of levels of power, voltage, or current in electric or electronic signals.

DBS Direct broadcast satellite: multiple satellite entertainment and information services received via satellite on a subscription basis.

DDS Direct digital system: a network whose component parts and signals, representing information of various types, are all transmitted via standardized digital signalling methods. In a DDS network, no analog-to-digital converters are necessary.

decoder A device designed to unscramble purposely scrambled television signals.

dedicated channels Channels reserved for specific uses. Government, education, and public-access cable TV channels are examples.

dedicated lines A leased or purchased line connecting two or more data communication sites exclusively for one vendor or user.

demarc Demarcation: the point(s) at which customer-provided equipment is connected to carrier-provided equipment.

demodulation The process of retrieving an original signal from a modulated carrier wave.

descrambler An electronic device that decodes encrypted satellite signals.

digital/analog An analog electrical signal employs an infinite number of degrees of change to convey information. For example, an AM radio station continuously varies the amplitude of its carrier signal, depending on the amplitude of the sound it is carrying. A digital signal, however, is always in one of two states ("on" or "off"), but varying at a rate fast enough that information encoded into numbers can be transferred. One of the biggest advantages of digital transmission is that, as long as a receiver can distinguish between the two states in the signal, noise will not affect it.

digital signals Digital technology converts audio, video, and data into a series of "off" and "on" signals that form a digital signal. Digital channels are generally more precise, less subject to interference, can carry more information, and can be transmitted at higher speeds than analog channels.

distance education/distance learning Instruction that takes place in a setting in which the teacher is in contact with the student through correspondence or telecommunication technologies. These technologies can link students and teachers within or between districts, states, or nations.

downconversion Translation of a frequency or a block of frequencies to a lower portion of the electromagnetic spectrum. An example is translating SHF (microwave) frequencies to UHF or VHF.

downconverter A device used to lower the frequency of any signal.

downlink A receive system for processing satellite information that includes the satellite, the receiving Earth station, and the signal transmitted between them. Occasionally, this word also is used to refer to the Television Receive Only (TVRO) dish itself.

downloading The process of transferring information from one device to another through telecommunications technologies. Information received from the originating source can be stored for future use.

duplex On a regular telephone system, the audio transmission can be considered "half duplex," because if both parties speak at the same time their voices will intercept on each end of the call. Most digital systems are duplex, making possible simultaneous and independent data (or encoded audio) to pass in each direction. Some systems may be "simplex," which means they pass information in only one direction.

dynamic allocation The ability, based on actual need, to add to, or remove resources from, a system. The alternative to dynamic allocation is when a fixed amount of resources are always dedicated to a system, regardless of whether they are being used.

Earth station Equipment located on Earth that can transmit or receive satellite communications. In general, this term refers to receive-only stations.

EBBs or BBs Electronic bulletin boards: systems that enable users who have computers equipped with modems and special software to read and post short public messages or announcements. Information is stored on a central computer that can be accessed by all members. Messages may be screened and posted within categories established by the system's operator.

educational television Television used for classroom instruction, enrichment, and community and cultural education.

electronic bulletin board See *EBBs*.

electronic classroom An instructional area characterized by the presence of two-way distance learning facilities, such as receive-only video and two-way audio. Sometimes also used to refer to a class that uses in-house educational video equipment, such as VCRs.

e-mail Electronic mail: networking systems that enable users to send and receive messages via computers and telephone modems.

encryption/decryption Special coding or scrambling of a communication signal for security purposes.

ERVING Embarrass River Valley Instructional Network Group: a consortium of seven Waupaca and Shawano County school districts that uses fiber optics for distance education.

Ethernet Baseband protocol and technology developed by Xerox and widely supported by many manufacturers; a packet technology that operates at 10 Mbs over coaxial cable and allows terminals, concentrators, workstations, and hosts to communicate with each other.

ETN Educational Teleconference Network: a four-wire dedicated telephone instructional system operated by the Instructional Communications Systems (ICS) of the University of Wisconsin-Extension. CTNs, ETN, and two-wire telephones can be interconnected at ICS in Madison.

facilitator The individual responsible for the local component at a distance education site. This person may or may not be an expert in the subject matter.

facsimile machine (FAX) Electronic technology that transmits text and graphics, usually over telephone systems. Also commonly referred to as telecopies or datafax.

feedback **1.** *Video.* Picture distortion when a video signal reenters the switcher and becomes overamplified. **2.** *Audio.* Unpleasant speaker howl when sound is inadvertently fed into the microphone and overamplified.

fiber optics A technology for transmission of voice, video, or data. Light is modulated and sent over high-purity, hair-thin fibers of glass. The bandwidth capacity of fiber optics cable is much greater than that of conventional cable or copper wire.

firmware Data and/or program software for the codec stored in a nonvolatile form in a semiconductor memory circuit. For codecs, the firmware is often housed in a plug-in module.

first mile connections Refers to the way programming is delivered from its source to a transmitter.

FM Frequency modulation: encoding a carrier wave by varying its frequency.

footprint Coverage area of a satellite beam; different satellites have different footprints, and some cover as much as one half the Earth.

FOTS Fiber optics transmission system.

four-wire telephone Dedicated telephone system that uses four wires (two to send and two to receive) and requires special telephone equipment. ETN and CTNs use this technology for interactive classes and meetings that link users over a wide area.

frequency The number of cycles per second of an electromagnetic transmission, usually described in hertz. Generally, high-frequency transmissions can carry more information at greater speeds than low-frequency transmissions.

full duplex A transmission system capable of simultaneously transmitting and receiving signals in both directions. Other systems are simplex (unidirectional) or half-duplex (one direction at a time).

gateway A device that connects two or more dissimilar networks and makes communication possible among them.

Gbs Gigabits per second: defines a rate multiple for data/information transmission over a communications line. One Gbs equals one billion bits per second, or approximately 125 million characters per second (assuming eight bits per character).

geostationary orbit An orbit located 22,300 miles above whe Earth's equator. In this orbit, a communications satellite rotates around the Earth at the same speed the Earth rotates, so the satellite appears to remain stationary when viewed from Earth.

geosynchronous Used to describe a satellite orbit that has a rotation period equal to that of the Earth's rotation. The term need not imply that the orbit is geostationary.

GHz Gigahertz: unit of frequency equal to one billion hertz or cycles per second.

GRADES Green and Rock Area Distance Education System: an ITFS user group in the Janesville area.

grainy picture A poor picture condition, usually the result of weak signal strength; characterized by a uniform distribution of noise appearing as spots or streaks throughout the picture.

half-duplex A circuit that permits communications in both directions, but not simultaneously.

half-transponder A method of transmitting two TV signals through a single satellite transponder by reducing the deviation and power allocated to each signal.

hardware Electronic equipment such as computers, satellite dishes, and video cameras.

HDTV High Definition Television: an emerging TV technology with better picture quality and a wider screen than standard TV. Most HDTV technologies are digital.

headend The central transmission point from which a CATV or MATV system distributes programming.

hertz A unit of frequency equal to one cycle per second (cps). One kilohertz equals 1,000 cps; one megahertz equals one million cps; one gigahertz equals one billion cps.

hop One leg of a microwave relay system.

hub A point or piece of equipment connecting a branch of a multipoint network. A network may have a number of geographically distributed hubs or bridging points.

hybrid system A system that combines two or more communication technologies.

IFL Inter-facility link: anything from a cross-site transmission line to a complete data network.

instructional telecommunications Telecommunications technologies used to deliver distance learning.

INTELSAT International Telecommunication Satellite organization.

ISDN Integrated Services Digital Network: the worldwide standard for digital telephony. The network signalling and transmission concept that utilizes standardized digital signalling methods and equipment to enable voice, data, and video information to be transferred simultaneously between users.

IT Information technologies.

ITFS Instructional Television Fixed Service: a technology to transmit television signals with frequencies higher than commercial television. This technology requires special licensing from the FCC and is reserved for educational institutions.

ITV Instructional television.

jack A connecting device arranged for insertion of a plug.

kbs Kilobits per second: a rate of data/information transmission across a communications line. 1 Kbs equals 1,000 bits per second, or approximately 125 characters per second (assuming eight bits per character).

Khz Kilohertz: refers to a unit of frequency equal to 1,000 hertz.

Ku-band satellite transmission Refers to frequencies in the 11 to 14 GHz band. The new generation of communication satellites sends and receives signals on this band.

LAN Local area network: a user-owned, user-operated, high-volume data transmission facility connecting a number of communicating devices—computers, terminals, word processors, printers, mass storage units, and so forth—within a single building or group of buildings.

laser Light amplification by stimulated emission of radiation: a highly focused beam of light, or its transmitting device, that is used in fiber optics and optical videodiscs.

last mile connections The means to deliver programming to its final receiver. For instance, a local ITFS system is the final connection when it delivers satellite-fed programming to television sets.

LCD Liquid crystal display: a very low-power device capable of displaying characters, words, and symbols, often built into a codec or room controller panel.

Learning Link A computer bulletin board for services related to education.

LED Light emitting diode.

line of sight Transmission path uninhibited by physical objects in the intervening terrain, but ultimately limited by the curvature of the Earth.

loopback To make tests easier, some digital equipment has loopback capability. Enabling loopback at different points on a network makes it easier to determine the defective portion.

lossless Negligible signal loss.

lossy Something that causes degradation of a signal, a lowering of the signal from the source to the end.

LPTV Low power television: stations with a signal that covers only ten to 15 miles and that cater to a specific audience.

MATV Master Antenna Television: an antenna system for a specific area, such as a school, hotel, or apartment building, that delivers a signal to many TV sets.

Mbs Megabits per second: a rate of data/information transmission across a communications line; 1 Mbs equals 1,000,000 bits per second, or approximately 125,000 characters per second (assuming eight bits per character).

MDS Multipoint Distribution Service: the commercial counterpart to ITFS, often referred to as "wireless cable" because it can deliver pay television programming directly to homes. MDS subscribers must install microwave antennas to receive program transmissions.

meet-me-bridge A type of telephone bridge that provides dial-in conferencing. It can be accessed by calling a telephone number.

MHz Megahertz: refers to a frequency equal to one million hertz.

microprocessor The heart of the computer, a silicon chip that processes data and controls the computer's components.

microwave A high-frequency range to transport audio, video, and data signals point-to-point. A single transmit and receive link can cover up to 40 miles, but this technology requires a clear line of sight geographically to deliver the signal.

microwave band The band of frequencies, 1,000 megahertz or greater, that uses very short waves. These bands are used primarily for point-to-point communications.

MMDS Multichannel Multipoint Distribution System (another term for MDS).

modem Modulator/demodulator: an electronic device that enables a computer to send and receive data, usually by telephone.

modulation The process of transmitting audio or video signals by encoding them onto a radio wave.

monitor Generally an electronic screen used specifically to display video information.

MSO Multiple system operator: a cable company that owns several systems.

MTS Multichannel television sound: a narrowcast technology that, in addition to providing stereo music, provides another channel for data delivery, additional language services, or supplementary instructional television services. Viewers need special equipment to receive MTS.

muldem A piece of equipment that provides multiplexing and digital interface capability for an optical network, such as fiber optics.

multiplex A process for transmitting multiple signals over a single channel.

multipoint A communications system that allows three or more sites to participate in the transmission of a signal.

narrowcasting As opposed to "broadcasting," it refers to television and radio designed to reach small, targeted audiences. The audio or video signal is transmitted from a central point and can be received with specialized radio and television equipment. ITFS, cable television, fiber optics, and satellite are examples of narrowcast technologies.

network A group of interconnected television or radio stations capable of simultaneously transmitting a given program.

networking The interconnection of multiple sites for the reception and possible transmission of information. Networks can be composed of various transmission media, including copper wire, terrestrial microwave, or coaxial cable.

NEWTEC Northeast Wisconsin Telecommunications Education Consortium: a group of school districts using ITFS for distance education and staff development in the Green Bay area.

node A termination point for two or more communications links. A node can serve as the control location to forward data over a network or multiple networks. It also can perform other networking and/or local processing functions.

noise Anything present between codecs other than the binary signal being transmitted. **1.** *Audio.* Unwanted sound signals. **2.** *Video.* Electronic interference.

NTIA The U.S. Department of Commerce's National Telecommunications Information Agency.

NTU National Technological University.

NUTN: National University Teleconferencing Network.

NWECS Northern Wisconsin Educational Communications System: a consortium consisting of the University of Wisconsin-Superior, Wisconsin Indianhead Technical College, the Superior School District, and CESA 12. It is developing an interactive fiber optics network.

OCR Optical character recognition or optical character reader.

origination capabilities Ability to send information whether it is in the form of video, audio, or data.

origination site The location from which a program is transmitted.

OSI Open System Interconnection: emerging standard for a layered architecture that enables data to be transferred among systems through networks.

OTA The U.S. Department of Education's Office of Technology Assessment.

PAL Phase alternation line: the broadcast standard in the United Kingdom, Germany, and some European countries.

parabolic dish A satellite antenna, usually bowl-shaped, that concentrates signals to a single focal point.

picture element The smallest discrete part of a video image, the size of which is controlled by an analog-to-digital conversion sampling process and other compression processes. The more picture elements per line, the higher the image resolution.

PIP Picture-in-picture display: a video display mode in which a one-quarter-size video image is superimposed over one quadrant of a full-screen video image.

polarization The property by which an electromagnetic wave exhibits a direction of vibration (or rotation sense), giving the opportunity for frequency re-use by orthogonal polarizations. Four types of polarization are used with satellites: horizontal, vertical, right-hand circular, and left-hand circular

POP Point of presence: location at which a customer can connect to a carrier's network.

port Point of access to a computer or a computer network.

program With respect to a state agency, a set of duties or services uniquely assigned by law.

Project CIRCUIT Trempealeau County Interactive Cable Network serving the county's school districts.

projection system A large screen system to show video or television images.

protocol Communication parameters necessary to make a connection between computers; two examples are baud rate and duplex.

protocol conversion The process of translating a protocol native to an end-user device, for example a terminal, into a different protocol. This enables that end-user device to communicate with another with which it previously had been incompatible.

PTFP Public Telecommunications Facility Program of the NTIA: funds from PTFP (and from an earlier version administered by the former U. S. Department of Health, Education, and Welfare) have financed much of the nation's public broadcasting system, including a substantial portion of state network facilities in Wisconsin.

RAM Random access memory: the most common computer memory, the contents of which can be altered at any time.

real time Said of the ability to send and receive messages simultaneously and without delay, also called "live."

receive dishes See *downlink*.

receive-only codec A video codec configured only to receive communications signals and process them for local output. For use at receive locations in point-to-multipoint or for broadcast applications in which two-way codec communication is not required.

redundant *Temporarily redundant*. Said of video data information that does not change over time. *Spatially redundant*. Said of video data information in which a given pixel is surrounded with similar pixels.

RETAs Regional educational telecommunications areas.

RF Radio frequency: an electronic signal above the audio and below the infrared frequencies

RFB Request for bid: written invitation to bid on a project that gives vendors of goods and services precise project specifications. Each vendor responds with a formal sealed bid that includes specific prices, and the customer selects one bid from those received.

RFI Request for information: request to vendors of goods and services for information. Used when there is little in-house expertise or when the need is conceptual. Vendors respond with general information and prices. Typically, a customer does not purchase from responses to an RFI but may use responses to develop a RFP or RFB.

RFP Request for proposal: invitation to vendors of goods and services, used when the best option may be in doubt, to gain information on the cost-effectiveness of various options. It describes what the customer wants to do and includes any constraints or conditions. Vendors describe how they would do what the customer wants, what they would provide, and the cost. The customer reviews the responses and selects one.

RFQ Request for quote: a shorter, less formal RFB used when a customer needs to replace specific equipment or to purchase one-time services or service contracts.

ROM Read-only memory: a type of semi-conductor memory device that stores unalterable data or program information.

SAP Separate audio program: a second audio channel available with every TV channel under the NTSC standard. Often used for bilingual teaching, with the SAP channel carrying program audio in a different language from the main audio channel.

satellite Electronic space vehicle located in a fixed geostationary orbit that retransmits signals from one location on the Earth's surface to one or more other Earth locations.

satellite time Time booked to use a communications satellite.

SCA Subsidiary Communications Authorization: an additional program channel that can be transmitted along with the regular stereo programming of an FM station.

School Radio Service Transmitted by SCA (Subsidiary Communication Authorization) Radio. It is transmitted with FM radio signals and received by special receivers.

scrambler A device that alters a picture so it cannot be viewed on a TV screen without a decoder.

SDN Software-defined network: a virtually private network in which network links are assigned as needed and typically are invoiced on the basis of bandwidth and time occupancy.

send-only codec A video codec configuration that allows only origination and transmission of communications signals. For use at the sending location in point-to-multipoint or for broadcast applications in which two-way codec communication with the receiving location(s) is not required.

service area The region in which a broadcasting or narrowcasting station signal can be received.

simplex A wire, channel, or carrier frequency that can accommodate only one message in one direction at one time. An example is a broadcast TV channel.

SMATV Satellite Master-Antenna Television: a pay-TV service delivered to rooftop Earth stations located on multidwelling units. The signal is then distributed to individual TV sets by coaxial cable.

software Programs, procedures, and related documentation associated with a computer system; sometimes used to refer to TV programming.

SONET Synchronous Optical Network: an emerging interface standard for digital signalling transmission and equipment in fiber optics networks.

STL Studio-to-transmitter link: any technical method of delivering a signal from a studio to a transmitter, such as coaxial cable and point-to-point microwave.

STS State Telephone System.

studio A room containing a camera, microphones, or other television or radio equipment necessary to originate a signal.

switching Process of routing communications traffic from a sender to the correct receiver.

synchronicity/synchronous "Live" or "real time" transmission and reception.

synchronization Many data networks simply provide a bit stream without any information on how to divide the bits into "words." Some networks use overhead bits to determine the "start" and "stop" of each word. If the codec is to ensure the best possible use of the data channel, it cannot afford the overhead required to provide alignment information not provided by the network. For this reason, the codec's receiver takes in raw, unframed data and analyzes it to determine the proper word alignment. This auto synchronization scheme enables the receiver to frame words with no other information. In the case of communication with a less sophisticated codec, the transmitter may be configured so that output words line up with network timing information, if available. This assures that the other codec will receive words aligned with the network timing.

sysop System operator, usually on a computer bulletin board.

tariff 1. A published rate charged for services provided by a common or specialized carrier. 2. The means by which regulatory agencies approve such services; the tariff is a part of a contract between customer and carrier.

TBC Time base corrector: a device used in conjunction with a playback from a VCR to provide sufficient timing stability to permit successful encoding of the video signal by the codec. Some codecs include a built-in TBC.

TDM/TDMA Time division multiplex/multiple access: a method of combining multiple data circuits into one circuit (or vice versa) by assigning each circuit a fixed unit of time for data transmission.

telecommunications The exchange of voice, video, or data through digital or analog electromagnetic signals.

teleconference Sharing of information when multiple sites separated by distance are linked together for communication. Among the types of information exchanged can be voice, video, and data.

telephony Transmission of speech or other sounds.

teletext Systems that transmit a text and graphics "magazine" to television sets equipped with special decoders that enable users to select individual pages. Most decoders include hand-held remote control keypads.

time-shifting Recording programs on a videocassette recorder for playback at a more convenient time.

translators Radio or television broadcast stations operating at relatively low power that receive a broadcast signal on one channel, amplify it, and retransmit it on another channel.

transponder The antenna-like part of a communications satellite that receives signals from the Earth, translates and amplifies them, and retransmits them back to Earth.

TVRO Television Receive Only: Earth station equipment that receives video signals from satellite or MDS-type transmissions. Such stations have only receiving capability and need not be licensed by the FCC unless the owner wants protection from interference. The sender grants authority for reception and use of material it transmits.

twisted pair A type of cable composed of two small insulated conductors twisted together without a common cover. Telephone signals are the most common type of information delivered using twisted pair technology.

UHF Ultra high frequency: received on broadcast television channels 14 through 83.

UNIX A computer operating system.

uplink The transmission power that carries a signal or material from its Earth station source up to a satellite.

upstream/downstream Cable industry jargon indicating whether a signal is traveling from the "headend" of a two-way cable system to the subscriber (downstream) or in the opposite direction.

VBI Vertical blanking interval: transmitted as a part of the television video signal in the black "bar" that can be seen at the top of the television picture. The FCC has granted commercial and public television stations the right to use the VBI for computer data transmission, software delivery (also called "telesoftware"), teletext, and paging services.

VCR Videocassette (cartridge) recorder: Device that uses special magnetic tape to record audio and video portions of a television program for replay.

VHF Very high frequency: refers to electromagnetic waves between approximately 54 MHz and 300 MHz.

VHS Video home system: the more popular of the two types of videocassette recorders.

video The demodulated and displayed electronic signal reconstructed as a viewable picture by a receiver such as a TV set. The picture is extracted from an analog or digitally encoded carrier wave that facilitates transmission.

video conferencing Using video and audio signals to link participants at different locations for a specific purpose. Video conferencing is a form of teleconferencing. When only voice links are used, the meeting is an audio conference.

videodisc Uses a laser to read information that has been encoded in a series of microscopic pits engraved in the disk. Discs permit precise and rapid access to individual frames or sequences of images, and have huge storage capabilities; one side of a disc can contain 54,000 distinct images or frames. Discs can be used for interactive video.

videotex or videotext An interactive data communications application designed to allow unsophisticated users to converse with a remote database, enter data for transactions, and retrieve text and graphics for display on subscriber television sets or low-cost terminals.

voice grade channel A channel for speech transmission, usually with an audio frequency range of 300 to 3,300 hertz. It is also used for transmission of analog and digital data. Up to 10,000 bits per second can be transmitted on a voice grade channel.

VSAT Very small aperture terminal: a small Earth station, usually four feet to six feet in diameter.

WANUC Wausau Area Narrowcast Users Consortium: ITFS group comprising K-12 and postsecondary users.

WestWING West Wisconsin Instructional Network Group: a group of schools and institutions in the St. Croix County region that is developing an interactive video-audio network for instructional purposes.

WICORTS Wisconsin Interagency Committee on Radio Tower Sites.

WIN Wisconsin Indianhead Narrowcast Network: a group of schools and the Wisconsin Indianhead Technical College-Rice Lake that share an ITFS system.

wireless cable Makes use of frequencies in the MDS (Multipoint Distribution Service), MMDS (Multichannel Multipoint Distribution Service), and OFS (Operational Fixed Service) ranges. The frequencies are reserved by the FCC for commercial use, sometimes along with ITFS frequencies, to form a transmission service, typically for entertainment programming.

WISCAT Wisconsin Catalog: CD-ROM catalog of materials owned by libraries around Wisconsin that was developed and is maintained by the Department of Public Instruction.

WISCNet Statewide data network serving higher education that is a gateway to the Internet. It includes all University of Wisconsin System campuses and other state colleges and universities.

WiseNet An electronic bulletin board and mail system maintained by DPI that can be accessed by dialing a toll-free telephone number.

WISLINE Teleconferencing bridge (connection) offered by UW-Extension's Instructional Communications Systems; permits up to 68 sites to be connected for a teleconference.

WISPLAN UW-Extension computer service providing agricultural "decision aid" programs, electronic mail, and other services to extension staff and their clients.

WiSPP Wisconsin Strategic Planning Project: a Department of Administration project designed to help state agencies develop strategic business and strategic information technology plans. It is also meant to develop a comprehensive statewide information technology plan.

WisSat A system of satellite dishes located at county courthouses provided by the UW-Extension's Cooperative Extension, they are to be used for educational purposes.

WisView An audiographics system for education programs that combines interactive audio with computer graphics. It is run by the UW-Extension's Instructional Communications Systems.

WITS Wisconsin Independent Telecommunication Systems.

WSTA Wisconsin State Telephone Association

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